

MIL-S-901C(NAVY)
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SUPERSEDING
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MILITARY SPECIFICATION

SHOCK TESTS, H.I. (HIGH-IMPACT); SHIPBOARD MACHINERY, EQUIPMENT AND SYSTEMS, REQUIREMENTS FOR

All interested bureaus of the Department of the Navy have concurred in the use of this specification.

1. SCOPE

1.1 Scope.- This specification covers the shock testing requirements for shipboard machinery, equipment and systems which are required to resist High Impact (HI) mechanical shock. The requirements are for the purpose of determining the suitability of machinery, equipment and systems for use under the effects of the severe shock which may be incurred in wartime service.

1.2 Classification.- Equipment and test classifications shall be of the categories specified in section 3.1 and as specified in the individual equipment specification.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids or request for proposal, form a part of the specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-P-15024 - Plates, Identification ____ Information and Marking for Identification of Electrical, Electronic and Mechanical Equipment.

MIL-P-15035 - Plastic Sheet, Laminated, Thermosetting, Cotton-Fabric Base, Phenolic-Resin.

MIL-S-16113 - Steel Plate, Hull and Ordnance, Structural, Black (Uncoated) and Zinc-Coated (Galvanized) (Navy).

THIS DOCUMENT CONTAINS 47 PAGES



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MILITARY (cont'd)

- MIL-S-20166 - Steel, Bars and Shapes (for Hull Construction) (Including Material for Drop and Miscellaneous Forgings).
- MIL-W-21157 - Weldment, Steel, Carbon and Low Alloy (Yield Strength 30,000-60,000 P.S.I.).
- MIL-E-22200/1 - Electrodes, Welding, Mineral Covered Iron-Powder, Low Hydrogen Medium and High Tensile Steel as Welded or Stress-Relieved Weld Application.

STANDARDS

MILITARY

- MIL-STD-8 - Dimensions and Tolerances.
- MIL-STD-9 - Screw Thread Conventions and Methods of Specifying.
- MIL-STD-10 - Surface Roughness, Waviness and Lay.
- MIL-STD-19 - Welding Symbols.
- MIL-STD-20 - Welding Terms and Definitions.
- MIL-STD-22 - Welded-Joint Designs.

DRAWINGS

BUREAU OF SHIPS

- 10-T-2145-L - HI Shock Testing Machine, Light Weight
- 645-1973904 - Floating Shock Platform, General Arrangement and Details
- NO807-655947 - HI Shock Testing Machine, Medium Weight

PUBLICATIONS

BUREAU OF SHIPS

- NAVSHIPS 250-423-30 - Shock Design of Shipboard Equipment, Dynamic Analysis Method.
- NAVSHIPS 250-423-31 - Shock Design of Shipboard Equipment, Interim Design Inputs for Submarine and Surface Ship Equipment.
- NAVSHIPS 250-660-30 - A Guide for Design of Shock Resistant Naval Equipment.
- NAVSHIPS 900-185 - Guide for the Design of Shock and Vibration Resistant Electronic Equipment.

NAVAL RESEARCH LABORATORY

- Report 5618 - Navy High-Impact Shock Machines for Light Weight and Medium Weight Equipment.

DAVID TAYLOR MODEL BASIN

UNDERWATER EXPLOSIONS RESEARCH DIVISION

- UERD report 7-61 - Floating Shock Platform for Shock Testing Equipment Up to 30,000 Pounds.



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(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 Other publications.- The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

NATIONAL BUREAU OF STANDARDS
Handbook H28 - Screw-Thread Standards for Federal Services.

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington 25, D.C.)

3. REQUIREMENTS

3.1 General requirements and definitions.- General requirements and definitions shall be as specified in 3.1.1 through 3.1.5.3.

3.1.1 Grades (see 6.1).-

3.1.1.1 Grade A.- Grade A items are machinery, equipment and systems essential for the safety and continued combat capability of the ship. Design shall be suitable to withstand shock loadings without significant effect on performance (see 6.1) and without any portion of the equipment coming adrift or otherwise creating a hazard to personnel or vital systems (see 3.2).

3.1.1.2 Grade B.- Grade B items are machinery, equipment and systems not required for the safety or continued combat capability of the ship. Design shall be suitable to withstand shock loadings without the equipment or any external portion of the equipment coming adrift or otherwise creating a hazard to personnel or vital systems.

3.1.2 Equipment classification (see 6.1).-

3.1.2.1 Hull mounted.- Hull mounted items are all machinery, equipment and systems or components thereof, located below the main deck and supported principally by the main structural members of the ship, including structural bulkheads. Items located on light platforms, decks or similar structure are excluded.

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3.1.2.2 Deck mounted.- Deck mounted items are machinery, equipment and systems or components thereof located on main deck or above for surface ships and items located on light platforms, decks and non-structural bulkheads for all ships.

3.1.2.3 Shell mounted.- Shell mounted items are equipment or components thereof attached directly to shell plating below waterline.

3.1.2.4 Principal units.- Principal units are items of equipment or assemblies of equipments which are the major parts of a system such as diesel-generator sets, air conditioning plants, switchboards, radio transmitters, steam generators, missile launchers or larger valves directly supported by ships structure.

3.1.2.5 Subsidiary component.- Subsidiary components are items of equipment or assemblies of equipments which form a part of, or are supported on, a principal unit. These would include such items as the diesel engine of a diesel-generator set, the electric motor of an air conditioning unit, the power supply section of a radio transmitter, a switchboard circuit breaker, items which are attached to the steam generator or a valve supported by the attached piping and similar items.

3.1.2.6 Subassemblies.- Subassemblies are parts or groups of parts of a subsidiary component or a system. This would include such items as thermometers, individual gages or meters, relays, resistors, and similar items. The distinction between subassembly and assembly or part as used herein may be different than that used in various equipment specifications. As used herein it is the smallest breakdown of a complete system which may be accepted as a separate unit under this specification.

3.1.3 Classes (see 6.1).-

3.1.3.1 Class I.- Class I equipment is defined as that which will perform its specified functions, under HI shock, without the use of either external or internal resilient mountings.

3.1.3.2 Class II.- Class II equipment is defined as that which will perform its specified functions, under HI shock, with the use of resilient mountings which are allowed or required by the individual equipment specification.

3.1.3.3 Class III.- Class III equipment is defined that which has shipboard applications both with and without the use of resilient mountings and is therefore required to meet both class I and class II requirements.

3.1.4 Test classification (see 6.1).-

3.1.4.1 Lightweight.- The lightweight test (see 4.2.3.1 and 4.2.4.1) is applicable to items weighing approximately 250 pounds or less (see 4.2.4.1.2).

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3.1.4.2 Medium weight.- The medium weight test (see 4.2.3.2, 4.2.4.1.2 and 4.2.4.2) is applicable to items weighing approximately 250 pounds to 6000 pounds. (The total weight of equipment and test fixture shall not exceed approximately 7400 pounds).

3.1.4.3 Heavy weight.- The heavy weight test (see 4.2.4.3) is applicable to items weighing approximately 6000 pounds to 30,000 pounds. Under certain circumstances heavier loads are possible (see 4.2.3.3).

3.1.5 Types (see 6.1).-

3.1.5.1 Type A.- Type A test is a test of a principal unit (see 3.1.2.4). The type A test is a preferred type of test and shall be specified whenever a testing facility or machine of sufficient capacity is available.

3.1.5.2 Type B.- Type B test is a test performed on a subsidiary component (see 3.1.2.5) and shall be performed for those cases where a testing machine or facility of sufficient capacity to perform a type A test of the principal unit is not available. A type A test may be required in addition to a type B test of the components as specified in the applicable equipment specifications. Inasmuch as a type B test applies to subsidiary components having specific applications, approval will be limited to the specific application.

3.1.5.3 Type C.- Type C test is a test of subassemblies (see 3.1.2.6) having a variety of shipboard applications. A subassembly approved under type C test may be used aboard ship, subject to any limitation specified in the approval letter. Shock tests of a principal unit shall be required even though all subassemblies of the unit have successfully passed type C testing. Any requests for waivers of this requirement together with assembly and mounting details of the components and supporting structure and suitable analysis shall be submitted to the bureau or agency concerned for approval.

3.2 Basis of acceptability.(see 6.1).-

3.2.1 Acceptability shall be based on machinery, equipment and system behavior during or following the specific tests in accordance with the requirements of the particular grade of shockproofness specified (grade A or B). Unless otherwise specified acceptance shall be based on the requirements of grade A (see 3.1.1.1). For grade A items where the minimum acceptable performance is not specified the requirements following the test shall be the same as those prior to the test.

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3.2.2 Extension of shock tests.- Action concerning previous acceptance of an item may be extended to cover another providing that it can be clearly shown that the original item was subjected to shock tests and successfully passed and that the design of the untested equipment, its intended services and shipboard installation are such as to result in an equal or better degree of shock resistance (see 6.2). Request for extension action, together with supporting evidence, shall be submitted to the bureau or agency concerned for approval. A design which has been approved by extension action shall not be used as a basis for further extension requests.

3.2.2.1 Extension of previously accepted items.- Items previously accepted in accordance with the requirements of the previous issue of this specification may be extended for acceptance under the requirements specified herein by meeting any additional testing specified herein.

3.3 Marking.-

3.3.1 Note for drawing.- Equipment which meets the requirements specified herein and has been approved as being of HI shock design shall include the following marking on the assembly drawing for the equipment.

- (a) Shockproofness grade A or B.
- (b) Basis of acceptance (shock tests on light weight, medium weight machine or floating shock platform, shock tests extended by letter _____, and so forth.
- (c) If shock tested the following additional information shall be provided:
 - (1) Type of mounting fixture used (for example), fixture 4A as shown on figure 5, fixture 4C as shown on figure 6, and 30-degree mounting as shown on figure 10, and other types of mounting fixtures.
 - (2) Equipment class (class I, II or III with _____ (external or internal) resilient mountings).

3.3.2 Marking on equipment using resilient mountings.- For class II and III when using external mounts, the Federal Stock number (FSN) (or commercial designation if FSN not applicable) of the intended mount shall be indicated at a location adjacent to each mount. The marking may be accomplished by a separate plate conforming to MIL-P-15024. This marking shall read as follows:

"Mount No. _____ (Federal stock no. or commercial designation) only is to be used in this location"

4. QUALITY ASSURANCE PROVISIONS

4.1 General quality assurance provisions.- Machinery, equipment and systems which are within the weight and space capacity of shock testing machines or facilities shall be demonstrated to be acceptable by shock testing or extension of shock tests in accordance with the applicable procedures of this specification.



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4.2 Shock testing.-

4.2.1 Standard Navy shock testing machines.- Shock testing machine for light weight, medium weight and heavy weight equipment shall be as follows:

- (a) Light weight equipment.- Shock testing machine shall be as shown on figure 1.
- (b) Medium weight equipment.- Shock testing machine shall be as shown on figure 2.
- (c) Heavy weight equipment.- Shock testing machine shall consist of a floating shock test platform as shown on figure 3.

4.2.2 Design of test fixtures.-

4.2.2.1 Type A.- For type A tests, the principal unit to be tested shall on the shock machine or floating shock platform in a manner simulating the most severe (as regards shock) service condition and method that can be used aboard ship (see 6.1). This mounting fixture shall be specified in the individual equipment specification. Means provided for securing the apparatus when installed on shipboard, shall be used in mounting the apparatus for the shock test.

4.2.2.2 Type B.- For type B tests, the subsidiary components shall be mounted in a manner which is approved by the bureau or agency concerned, as being dynamically equivalent to the mounting provided when they are assembled to form the principal unit. When a specific fixture design is not specified in the individual equipment specification the contractor shall provide a fixture for shock testing the component which will produce the same natural frequencies (plus 20 percent, minus 10 percent) as those present on the complete and installed principal unit. If alternate methods of attachment to the principal unit are possible then the test fixture shall be designed to simulate the most severe condition.

4.2.2.3 Type C.- Type C, subassemblies shall be subjected to shock tests only if they will have general applications. Such subassemblies shall be mounted on the test machine in the manner specified in the individual equipment specification or shall be mounted so as to simulate the most severe condition which may be encountered in service.

4.2.3 Methods of mounting (see 6.1).-

4.2.3.1 Light weight equipment.- The shock machine for light weight equipment is provided with the anvil plate as shown on figure 4. Unless otherwise specified in the contract or order, or the individual equipment specification, the apparatus to be tested shall be mounted by means of standard mounting fixtures 4A, 4C, 6D-1, 6D-2 or 6E as shown on figure 5 through 8 or a substitute approved by the bureau or agency concerned (see 4.2.2.2).

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4.2.3.1.1 An item of equipment that has passed the shock test when mounted on fixture 4A or 4C as appropriate, need not be retested for applications where the fixture 6E mounting would ordinarily be required. For example, a switch that has passed tests on fixture 4A or 4C need not be retested on fixture 6E if it is to be utilized as a controller component. When an item of equipment has passed shock tests mounted on the fixture 6D or 6F, it shall be limited to applications for which these mountings are appropriate. Where a specific test fixture is designated in the individual equipment specification, the fixture shall be utilized in all instances unless exception is made by the bureau or agency concerned.

4.2.3.1.2 When the equipment has been mounted for a test upon a standard fixture, its position upon the fixture shall not be changed during the course of the test.

4.2.3.1.3 There shall be no variation in the construction of these standard fixtures without specific approval of the bureau or agency concerned. In the event that none of the standard fixtures can be utilized for a particular piece of equipment, or if there is some doubt as to which fixture is applicable, the bureau or agency concerned shall be consulted. It is the intent of these standard fixtures to approximate the actual rigidity encountered aboard ship in the utilization of the particular equipment.

4.2.3.2 Medium weight equipment.— The shock machine for testing medium weight equipment shall be as shown on figure 2. The equipment shall be attached to the anvil table of the machine by means of a fixture, as specified in 4.2.2. In general, the fixture should provide a stiffness approximately equivalent to the most rigid mounting on which the equipment would normally be placed aboard ship. The standard mounting platforms shown on figures 9-1, 9-2 and 10-1 and 10-2 are approved for use unless mounting adaptors differing from those shown are specified in the individual equipment specifications.

4.2.3.3 Heavy weight equipment.— If the location and characteristics of the shipboard structure are not known, or if several locations are possible, the equipment shall be installed in a manner to simulate the most severe condition likely to be encountered. The unit shall be attached to its foundation and test fixture for tests in accordance with the manufacturer's installation drawings. The upper weight limit of approximately 30,000 pounds (40,000 pounds at the San Francisco Naval Shipyard facility) is established for equipment on the floating shock platform and may be reduced or increased depending on the individual test installation as it affects the stability of the test machine.



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4.2.4 Test procedure.- The apparatus or equipment shall be tested in each of the operating conditions specified in 6.1 for example, motors shall be tested running at rated speed and at standstill, and contactors shall be tested in the open and closed position and equipment shall be tested at design pressure. Directional test on the light weight and medium weight shock machines may be scheduled to minimize changes in test set-ups. Unless otherwise specified in the individual equipment specification, the procedure shall be as specified in 4.2.4.1 through 4.2.4.3.

4.2.4.1 For light weight equipment.-

4.2.4.1.1 A total of nine blows shall be applied, employing the machine shown on figure 1. Three blows shall be applied parallel to each of three principal axes of the apparatus being tested, the three blows for each direction to be with heights of hammer drop of 1 foot, 3 feet, and 5 feet. For light weight equipment having two or more electrical or mechanical operating conditions (for example, circuit-breakers and switches), the nine blows shall be delivered for each condition; separate items of equipment may be submitted for each series of nine blows if desired by the manufacturer.

4.2.4.1.2 Equipment within the range of 250 to 400 pounds may be tested on the light weight machine if specified by the bureau or agency concerned. Requests for HI shock tests on equipment in this weight range shall indicate whether tests are desired on the light or medium weight machine. A note shall also be incorporated on the applicable drawing indicating the shock machine utilized.

4.2.4.2 For medium weight equipment.- Tests for medium weight equipment shall be made on the medium weight shock machine shown on figure 2. The mode of equipment operation during the tests shall be as specified in individual equipment specification. A minimum of six blows shall be applied (see 4.2.4) consisting of three groups of two each. For each group, the height of hammer and the initial up travel of the anvil table shall be as shown in table I. One blow of each group shall be with the equipment mounted on an inclined orientation. The fixture used shall conform to the requirements specified in 4.2.3 and should be similar to the fixture shown on figure 10-1 or 10-2. Additional blows in each group may be required by the individual equipment specification to account for special modes of equipment operation or other mounting axis orientations.

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Table I - Test schedule for medium weight shock machine.

Group number-----	I	II	III
Number of blows-----	2	2	2
Anvil table travel, inches-----	3	3	1-1/2
Total weight on anvil table, ¹ (Pounds)	Height of hammer drop ² (Feet)		
250 - 1,000	0.75	1.75	1.75
1,000 - 2,000	1.0	2.0	2.0
2,000 - 3,000	1.25	2.25	2.25
3,000 - 3,500	1.5	2.5	2.5
3,500 - 4,000	1.75	2.75	2.75
4,000 - 4,200	2.0	3.0	3.0
4,200 - 4,400	2.0	3.25	3.25
4,400 - 4,600	2.0	3.5	3.5
4,600 - 4,800	2.25	3.75	3.75
4,800 - 5,000	2.25	4.0	4.0
5,000 - 5,200	2.5	4.5	4.5
5,200 - 5,400	2.5	5.0	5.0
5,400 - 5,600	2.5	5.5	5.5
5,600 - 6,200	2.75	5.5	5.5
6,200 - 6,800	3.00	5.5	5.5
6,800 - 7,400	3.25	5.5	5.5

¹Total weight on anvil table is the sum of equipment weight plus weight of mounting.

²The height of hammer drop shall be measured by means of the existing markings on the scale of the machine, no corrections being made for the added anvil table travel for the blows of groups I and II.

4.2.4.3 For heavy weight equipment.- Tests for heavy weight equipment shall be conducted on the floating shock test platform shown on figure 3. Unless otherwise specified in the individual equipment specification, the test series shall consist of five shots using 60 pound charges suspended 24 feet below the water surface, at horizontal range of 60, 40, 30, 25, and 20 feet, from the near side of the platform. Requirements for equipment operation, orientation, inspection, instrumentation, and similar facilities, shall be as specified by the bureau or agency concerned. Navy Department, Bureau of Ships, Code 423, David Taylor Model Basin or the San Francisco Naval Shipyard may be contacted regarding use of these facilities.

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4.2.5 General test procedures.-

4.2.5.1 All mounting bolts of the test item and shock machine mounting shall be tightened before each blow only as necessary to compensate for the loosening due to seating in of the mating surfaces. Excessive bolt yielding or loosening shall be considered as cause for rejection.

4.2.5.2 The behavior of the equipment under test shall be recorded when and as specified by the bureau or agency concerned (see 6.1).

4.2.5.3 The test report prepared by the test activity shall include detailed descriptions of any damage incurred during each blow, and, where practicable, photographs showing the damage incurred should supplement this description. When equipment performance under test is monitored, as may be required by the applicable individual equipment specification, a copy of such records shall be included in the test report. In addition the overall dimensions, the weight, and the approximate location of the center of gravity of the equipment, together with a sketch or photographs of the method of mounting on the shock-testing machine, shall be recorded and shall be included in the report.

4.2.5.4 After completion of the shock tests, grade A machinery, equipment and systems shall be given suitable test to determine whether or not it performs its specified functions (see 6.1). For equipment on which hydraulic pressure tests are required such tests shall be made at the pressure specified for tests in the individual equipment specification. Grade B machinery, equipment and systems, shall be given sufficient tests to insure that as a result of the shock tests no personnel or other hazards are created such as serious steam leaks, release of toxic gases, electrical shorts or other hazards.

4.2.6 Disposition of shock tested equipment.- When a test sample has satisfactorily passed the shock test and is to be retained by the government, the manufacturer shall thoroughly examine the sample and correct all damage which may have occurred during the test. Upon completion of shock test a post-shock test examination and corrective measures as specified in the individual equipment specification shall be performed. Disposition of the test sample shall be as specified in the individual equipment specification.

4.2.7 Test records - government and commercial test facilities.-

4.2.7.1 Form.- The results of shock tests shall be recorded on form NAVEXOS 3373 (see 6.3). A copy of the completed form together with copies of other required data shall be submitted by the testing facility to the ordering activity and to the bureau or agency concerned.

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4.2.7.2 Acceptance report.- If the equipment passes the HI shock test satisfactorily, as determined by the Government reviewing authority or other reviewing authority, the equipment may be accepted as far as shock is concerned or referred to the procuring activity for action. A copy of the reviewing action, along with a copy of the test report, shall be forwarded to the procuring activity.

4.2.7.3 Rejection report.- If the equipment fails to pass the HI shock test satisfactorily, as determined by the Government reviewing authority or other reviewing authority, the manufacturer shall be so advised. The manufacturer shall then inform the procuring activity, via the Government reviewing authority or other authority, as to the proposed design changes which will correct the deficiencies. In certain cases the bureau or agency concerned may decide to accept the equipment as HI shockproof on the basis of the corrective design changes rather than to require retests.

4.2.8 Design guidance for shock tests.- Section 6.2 and the following documents provide useful information for the design and analysis of items which are required to pass shock tests. The application of this design guidance material shall not detract from or take precedence over successfully passing the test requirements specified herein.

- (a) NAVSHIPS 250-660-30.
- (b) NAVSHIPS 250-423-30.
- (c) NAVSHIPS 250-423-31.
- (d) NAVSHIPS 900-185-A.
- (e) Naval Research laboratory Report 5618.
- (f) UERD Report 7-61 (Explains general procedures and provides typical input motions).

5. PREPARATION FOR DELIVERY

5.1 This section is not applicable to this specification.

6. NOTES

6.1 Ordering data.- Procurement documents should specify the following:

- (a) Title, number and date of this specification.
- (b) Grade (A or B) of shockproofness required (see 3.1.1).
- (c) Equipment classification (see 3.1.2).
- (d) Classes required (see 3.1.3).
- (e) Tests classification (see 3.1.4).
- (f) Types required (see 3.1.5).
- (g) Definition of "failure to perform specified functions".-
(Define minimum acceptable performance of the equipment or component during and following shock test such as extent of

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- momentary malfunction if permitted, degree of permanent deformation if permitted, degree of permanent functional impairment allowed, maximum misalignment, operational checks after shock test such as meeting a specified hydrostatic test pressure, insulation breakdown tests, leakage rates, (see 3.2, 3.2.1 and 4.2.5.4).
- (h) Method mounting equipment for test. - (Designate test fixture to be used, method of simulating reactions of attached loads such as piping connections and other external test if other than specified in this specification) (see 4.2.3).
 - (i) Mode of equipment operation during tests.- (Energized, de-energized or both, pressurized, rated speed or other operating conditions, special monitoring or other instrumentation required) (see 4.2.4 and 4.2.5.2).
 - (j) Disposition of shock tested samples.- (Deliver for use aboard ship, acceptable after specific repairs) (see 4.2.6).
 - (k) Exceptions to this specification.
 - (l) Number of individual articles from each manufacturing lot to be tested.

6.2 General information.-

6.2.1 The following information is listed herein for the assistance of the designer and, for the assistance of the bureau or agency concerned approving drawings prior to manufacture:

- (a) All items have motion under shock. Nothing is "rigid" except in a relative sense.
- (b) The relative deflection of components under shock can be quite large and accordingly there should be ample clearances and sufficient lead wire length, and so forth, to prevent electrical short circuits, collision damage and broken or over-strained connections.
- (c) Desirable material properties are strength, ductility (at least 10 percent elongation), and, in some cases, low density. Undesirable properties are brittleness, low impact resistance, and high notch sensitivity.
- (d) In the application of material, ample cross sections should be provided and factors causing stress concentration such as sharp notches and sudden changes in cross section should be avoided.
- (e) In the design of mechanisms (for example, voltage regulators and relays) well constructed hinges or shafts and bearings are preferred to knife-edge pivots.

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- (f) Levers, linkages and other moving parts of mechanisms should be dynamically balanced (either individually or in groups), whenever practicable, in order to reduce the tendency to mal-operate under shock. This is particularly applicable to such items as circuit-breakers, rotary solenoids, and relays.
- (g) The cantilevering of components should be avoided since such mountings deflect excessively and can produce large stresses. Such arrangements can also lead to problems under shipboard vibration conditions. Adequate consideration should be given to the frequency relationship between the expected shock environment, the equipment on its foundation and internal or external components. Any condition of near resonance can be expected to produce excessive shock response and therefore should be avoided.
- (h) Friction cannot be depended upon as a means for retaining relative position of components under dynamic loads. A positive means for holding, driving and positioning should be used in lieu of any frictional device regardless of its apparent static holding power.
- (i) Components or assemblies which are designed to provide quick access or removal must have adequate means to provide secure lock-in and support when in their normal operating position.
- (j) Bolted joints. Where bolts (cap screws, machine screws and studs are included), are installed in clearance holes the clearance should be minimized to properly share bolt shear loads and to reduce the effect of impacting due to load reversals under shock. The following is for general guidance:

<u>Nominal bolt diameter</u>	<u>Maximum diameter of hole</u>
3/4 inch and smaller	Nominal bolt diameter plus 1/32 inch
Larger than 3/4 inch	Nominal bolt diameter plus 1/16 inch

Where alignment must be maintained, fitted bolts or other positive methods should be used. All bolted joints tend to loosen under shock. Proper bolt design, sufficient pre-stress and adequate finishing and sizing of joint surfaces can eliminate or reduce this tendency. For joints employing "O" rings of similar sealing devices, proper bolt pre-stressing is essential to prevent the flanges from parting under shock, even momentarily, and the gasket being displaced (by action of the internal hydrostatic forces).



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In general, bolts should be tightened (pre-stressed) to a maximum value consistent with the allowable stress, the effects of combined loads and operating conditions. Friction type lock nuts and similar locking devices may help to preserve the initial pre-stressing and will be of value towards minimizing the possibility of additional damage in the event the joint does become loose following shock loadings. Except for very small items of equipment, such as gages, mounting bolts less than 1/2 inch in diameter should not be used because of the inherent danger of overstressing during the initial or subsequent tightening. Reduced shank or hollow bolts increase the capability of the bolt to absorb energy, however, in almost every case of joint design it is desired to transmit energy rather than absorb it.

- (k) Welding. When possible locate welded joints away from highly stressed areas. The effects of stress reversals must be considered in joint selection. Weld sizes should make allowance for corrosion, difficulty in welding, discontinuities and other factors which tend to reduce strength. The effect of heat on the material as a result of welding, especially aluminum and similar materials, should be determined and allowed for. The ability to perform weld inspections satisfactorily should be considered in the design of joints.
- (l) Piping. Threaded pipe and fittings should be avoided. Where threaded connections cannot be avoided, flexibility should be provided to minimize the load on the threads. Flexibility should be provided in piping runs between different components or where they are attached to structures that can have relative movement under shock. The inertia effects of piping can be large and sufficient support should be provided so as not to over-stress or in some cases even elastically deform the equipment or associated valve or fitting excessively.
- (m) Shock mounts. Shock mounts may be employed, based on a definite need, and only after a careful review of the design indicates that it is not otherwise feasible to meet the shock requirements. Where a need for shock protection is established, the mount characteristics should be determined based on a knowledge of the particular shock environment and the dynamic nature of the equipment. Mounts must also be compatible with other shipboard environments, such as vibration and service conditions, and as such should meet the requirements of MIL-M-17185.

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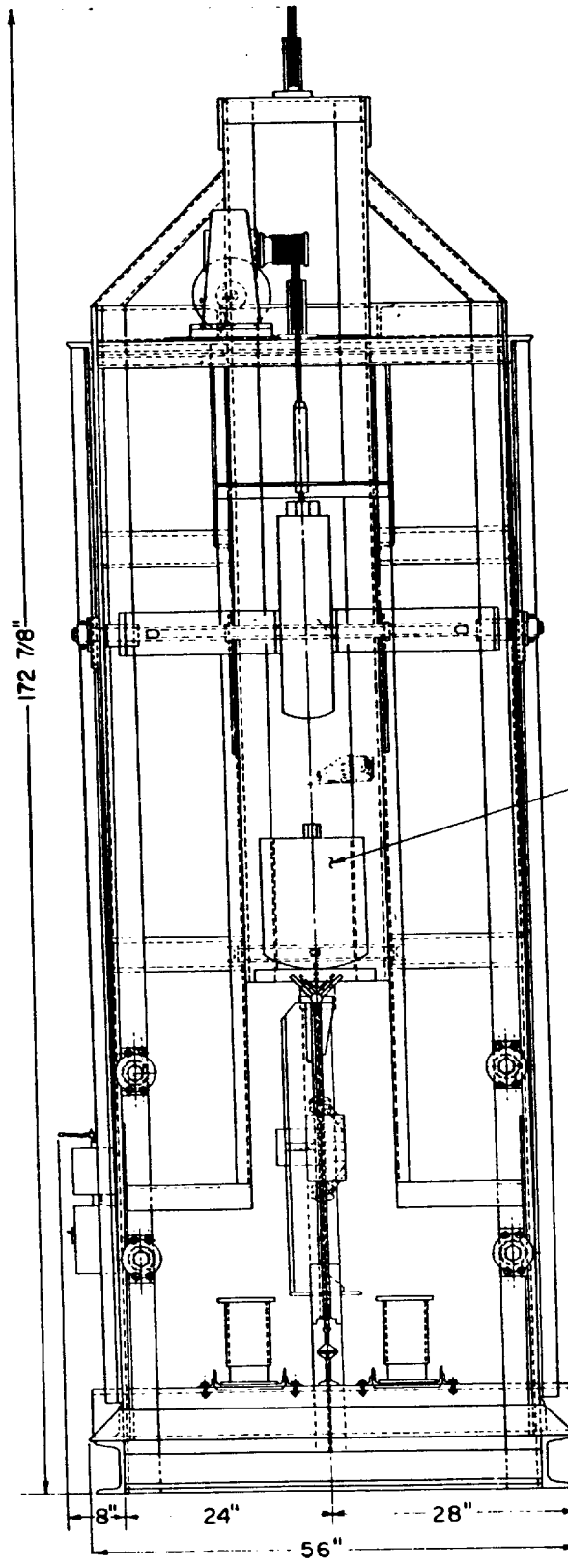
Most mountings have non-linear characteristics and their properties under normal loading often change radically with the large amplitudes and rates of loading encountered under shock. Mount deflection under shock, especially for base mounted equipment should be considered in specifying the clearances around the equipment and in the design of connections such as wave guides and similar connections. All mountings must have a positive, mechanical captive nature in their design.

6.2.2 This specification is very general so as to cover the entire field of shipboard machinery, equipment and systems. In order to apply this specification properly, it is necessary to specify separately, describe, or define the features enumerated in 6.1.

6.3 Test record. - For shock tested equipment the applicable test record form is NAVEXOS 3373, Factory Test Record, HI Shock. Pads of these forms may be obtained upon application to the Government inspector, except that activities of the Department of Defense should make application to the Commanding Officer, Naval Supply Depot, Philadelphia 20, Pennsylvania. When requesting forms refer to both the title and number.

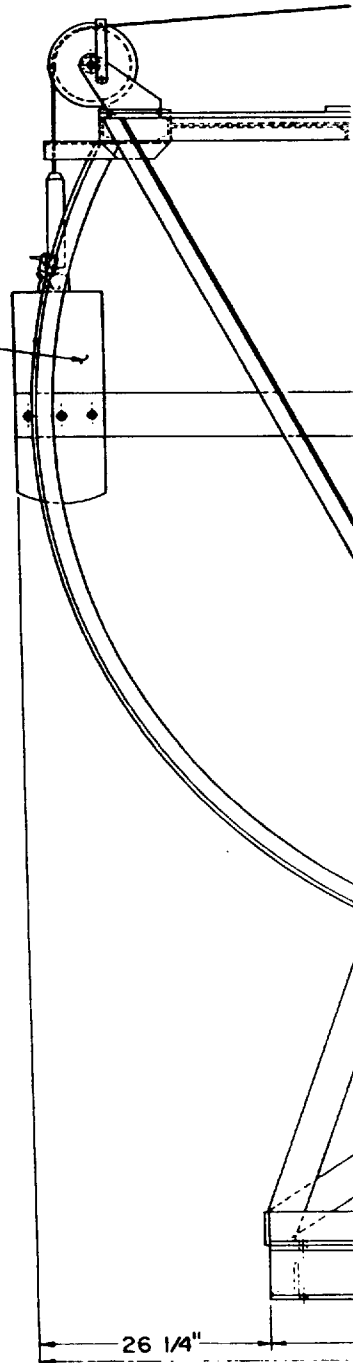
Notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Preparing activity:
Navy - Ships
(Project MISC-N013(NAVY))



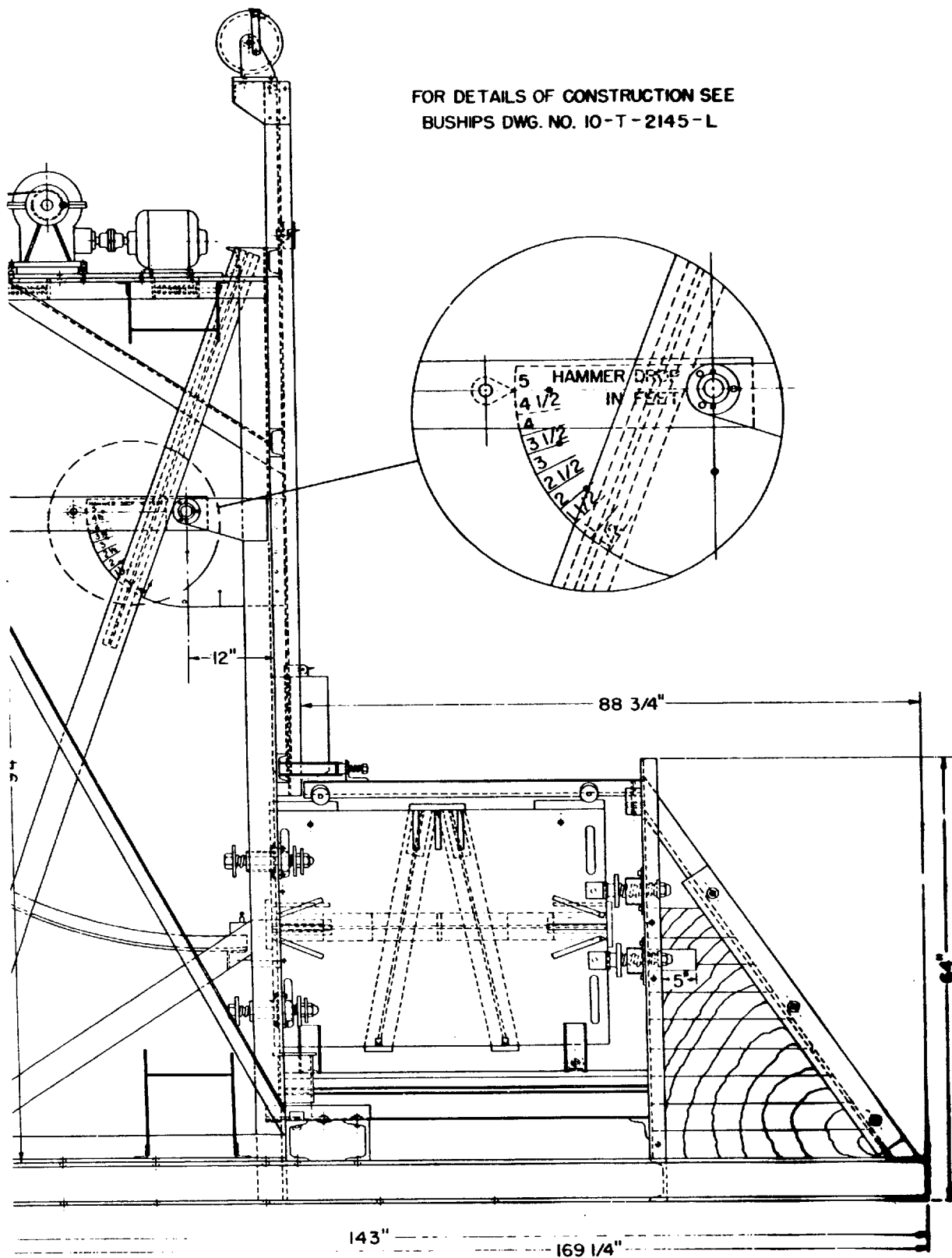
HAMMER
WEIGHT
400LBS

HAMMER
WEIGHT
400LBS



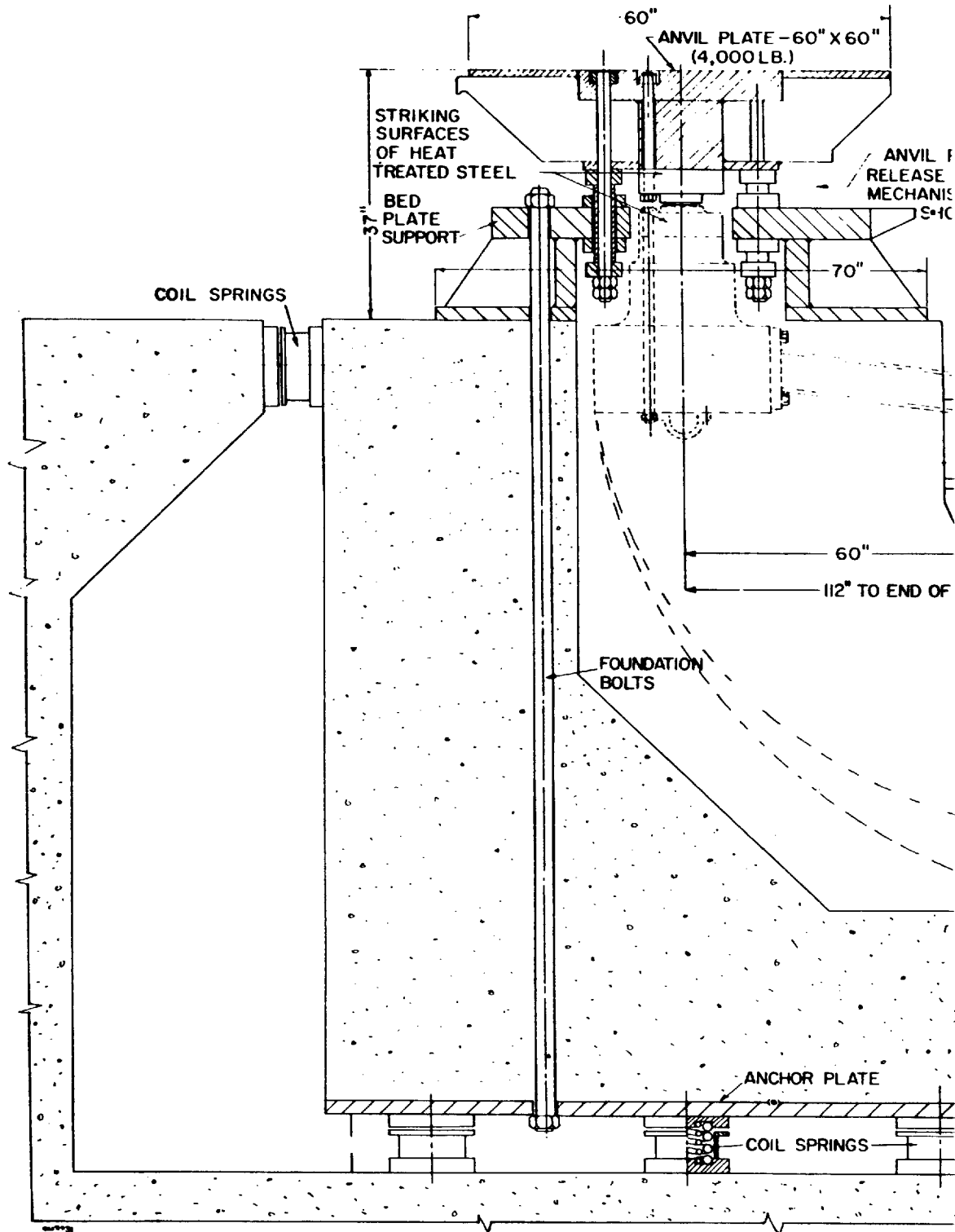
SHOCK TESTING MACH

FOR DETAILS OF CONSTRUCTION SEE
BUSHIPS DWG. NO. 10-T-2145-L



IE FOR LIGHT WEIGHT EQUIPMENT

FIGURE 1

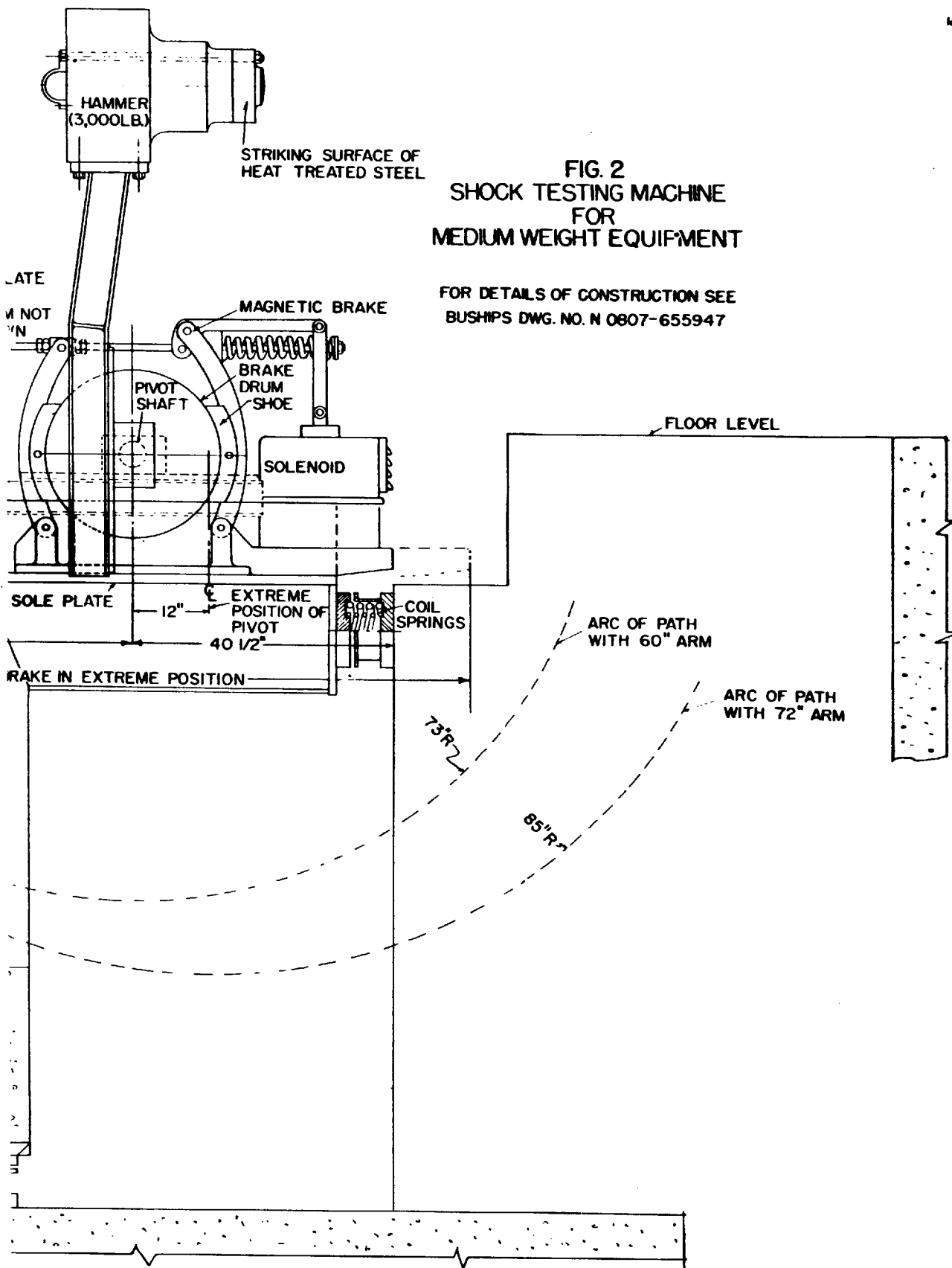


ELEVATION

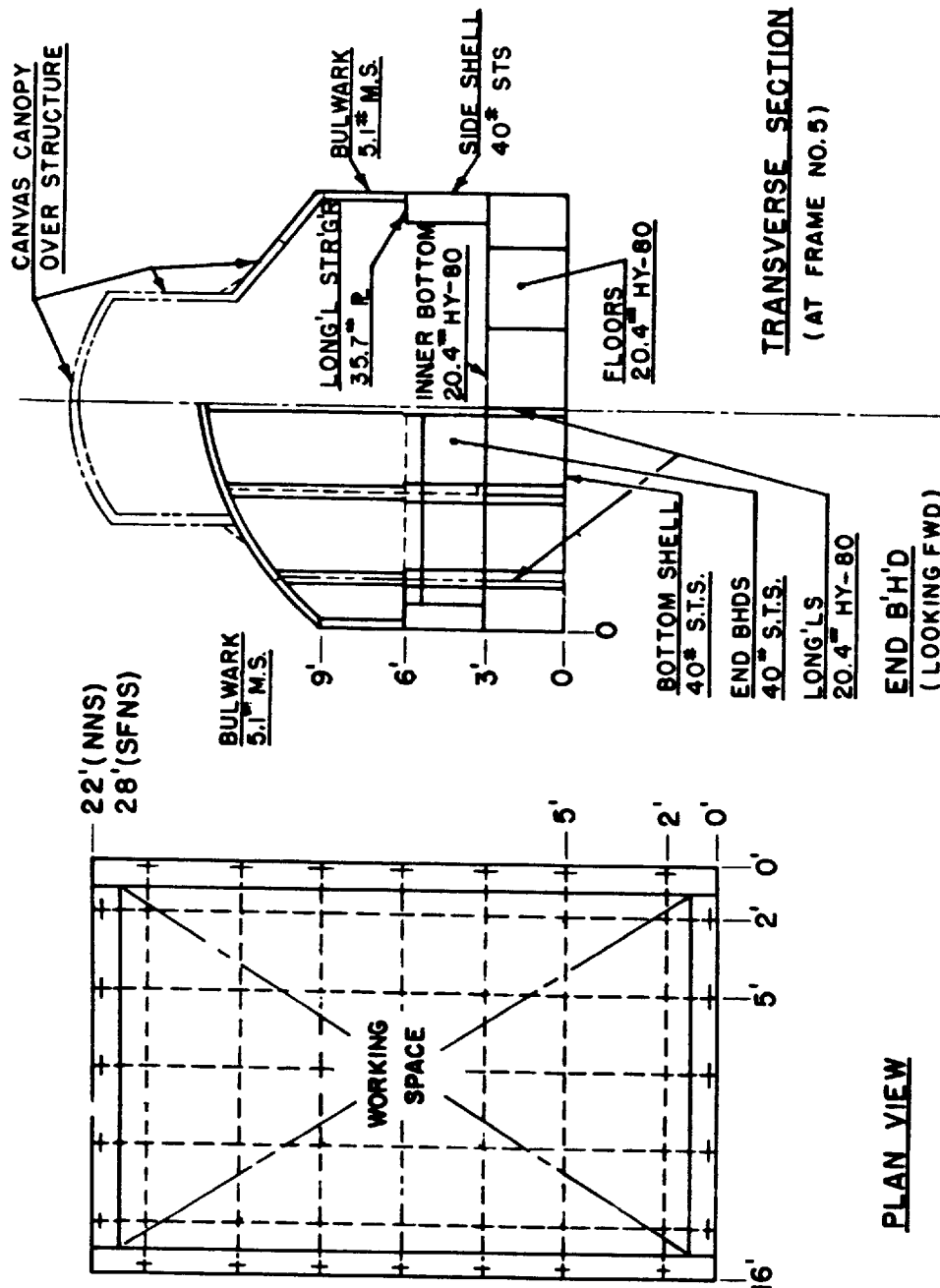


FIG. 2
SHOCK TESTING MACHINE
FOR
MEDIUM WEIGHT EQUIPMENT

FOR DETAILS OF CONSTRUCTION SEE
BUSHIPS DWG. NO. N 0807-655947



MIL-C-901C(NAVY)



FLOATING SHOCK TEST PLATFORM-FIGURE 3

(SEE BUSHIPS DWG NO. 645-1973904 FOR CONSTRUCTION DETAILS)

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MIL-C-901C(NAVY)

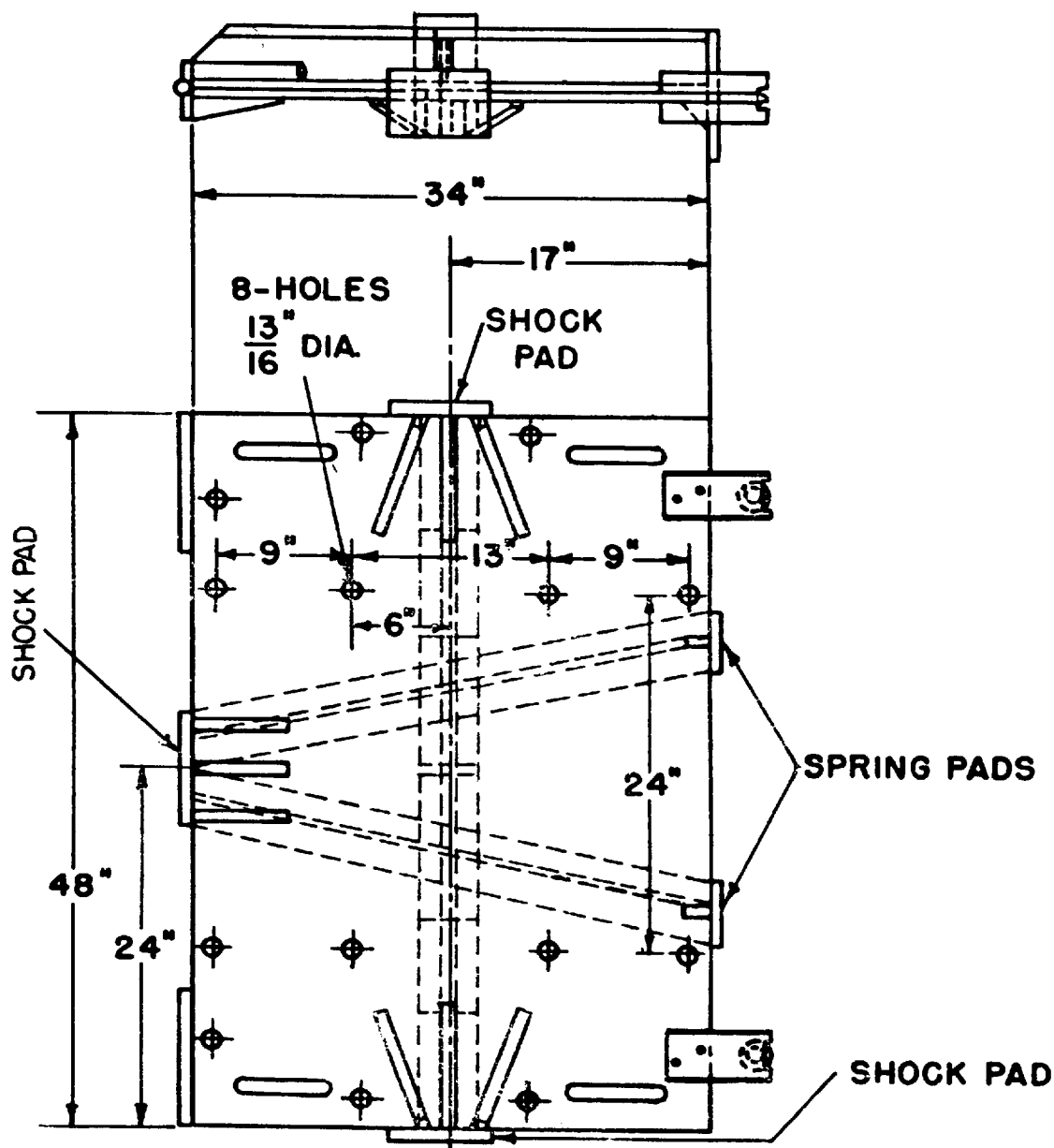


FIGURE 4.- ANVIL PLATE OF SHOCK-TESTING MACHINE
FOR LIGHTWEIGHT EQUIPMENT

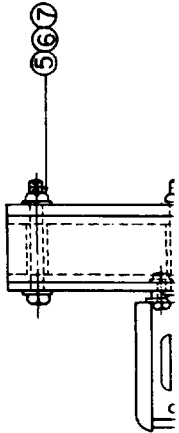
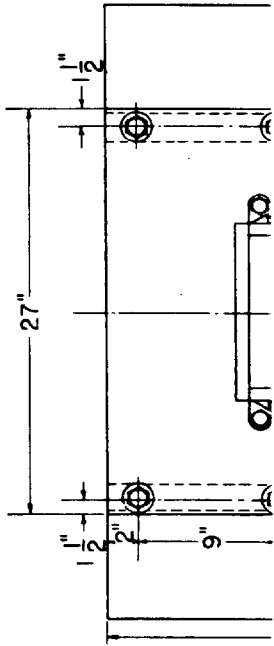
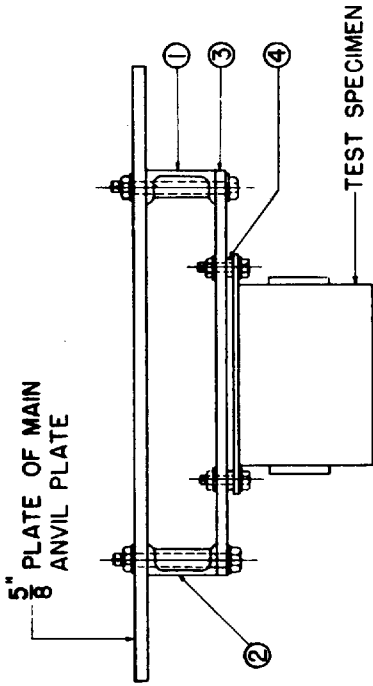
34 7350

LIST OF MATERIALS (TABLE II)			
QUANTITIES ARE FOR: ONE MOUNTING			
PIECE NO.	ITEM	SIZE	NO. REQ'D
1	CAR BUILDING CHANNEL ✓	4" x 13.8	1
2	CAR BUILDING CHANNEL ✓	4" x 13.8	1
3	AUXILIARY MOUNTING PL. ✓	1" ✓ 2	1
4	SPACER ✓	SEE TABLE III	1 / BOLT
5	HEX. HD. BOLT ✓	3" - 10 x 7" LG.	8
6	HEX. HD. NUT ✓	3" - 10 x 7" LG.	8
7	WASHER ✓	2" O.D. x 13" I.D.	16
8	1" STD. PIPE SPACER ✓	2 15" LG.	8

1 ✓ STEEL

2 ✓ STEEL (HEAT TREATED)

3 ✓ SIZE MAY BE INCREASED IN WIDTH ONLY FROM 27" TO A MAXIMUM OF 36" AS REQUIRED FOR LARGE ITEMS OF EQUIPMENT.



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MIL-C-901C(NAVY)

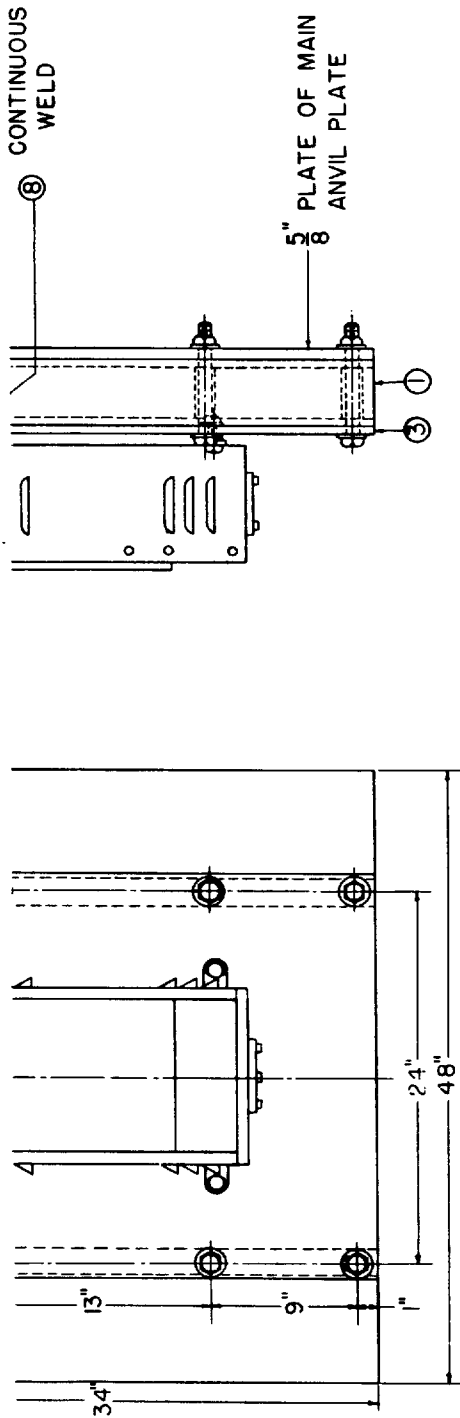


FIGURE 4-A
STANDARD MOUNTING FOR
BULKHEAD MOUNTED EQUIPMENT
(TYPE "A" TEST LWSM)
FIGURE 5

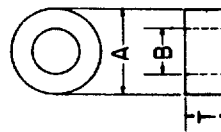


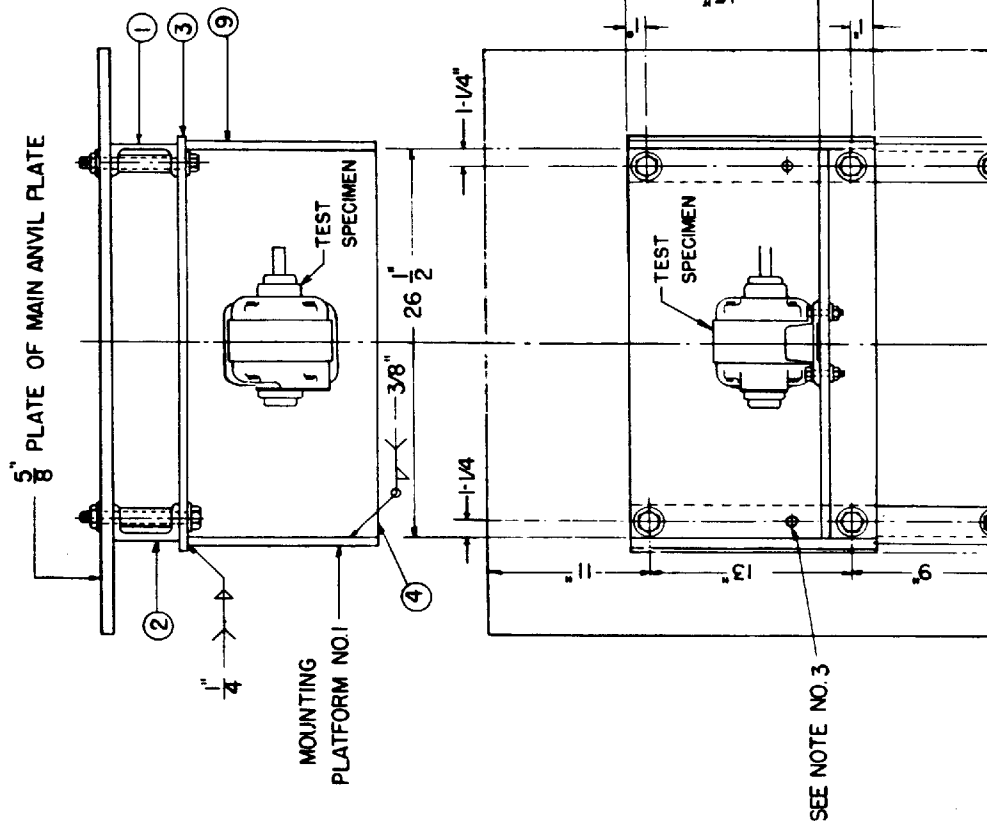
TABLE III
SPACER DIMENSIONS

BOLT SIZE	DIMENSIONS		
	A	B	T
1/4 INCH	3/4	9/32	3/8
5/16 INCH	3/4	11/32	3/8
3/8 INCH	7/8	13/32	3/8
1/2 INCH	1 1/4	9/16	1 1/2
5/8 INCH	1 1/2	11/16	5/8
3/4 INCH	1 3/4	13/16	3/4

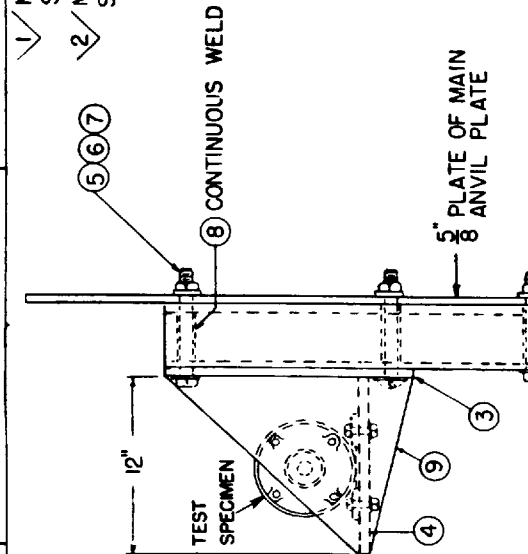
↓ SPACERS TO BE USED WHEN SECURING EQUIPMENT TO THE 1/2" AUXILIARY MOUNTING PANEL (PIECE NO. 3)
↗ ONE SPACER SHALL BE USED FOR EACH EQUIPMENT MOUNTING BOLT

34 01514

TABLE IV LIST OF MATERIAL			
QUANTITIES ARE FOR 3 MOUNTINGS			
PC NO.	ITEM	SIZE (INCHES)	NO REQ
1	CAR BUILDING CHANNEL	4 BY 13.8 #	1
2	CAR BUILDING CHANNEL	4 BY 13.8 #	1
3	AUXILIARY MOUNTING PLATE	3/8	1
4	HORIZONTAL MOUNTING PLATE	1/2	1
5	HEXAGON HEAD BOLT	3/4-10 BY 7 LG.	6
6	HEXAGON HEAD NUT	3/4-10	6
7	WASHER	2 O.D. BY 13/16 I.D.	12
8	STANDARD PIPE SPACER	1"x 2 15/16 LG.	6
9	GUSSET PLATE	3/8	2
10	GUSSET PLATE	3/8	2
11	GUSSET PLATE	3/8	2
12	HORIZONTAL MOUNTING PLATE	1/2	1
13	HORIZONTAL MOUNTING PLATE	1/2	1
14	STIFFENER	3/8	4
15	AUXILIARY MOUNTING PLATE	3/8	1
16	AUXILIARY MOUNTING PLATE	3/8	1

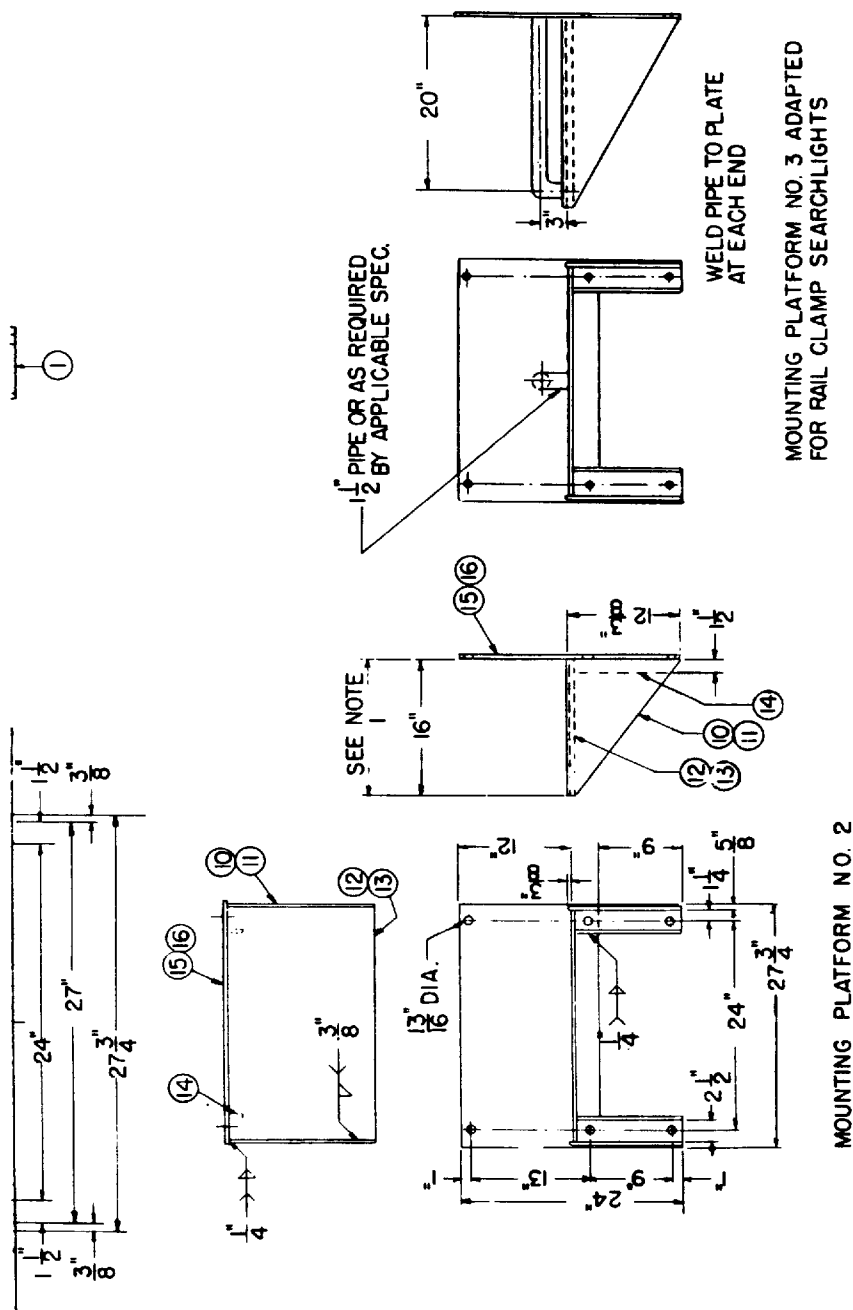


1/ MATERIAL SHALL BE STEEL
2/ MATERIAL SHALL BE STEEL (HEAT TREATED)



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NOTES

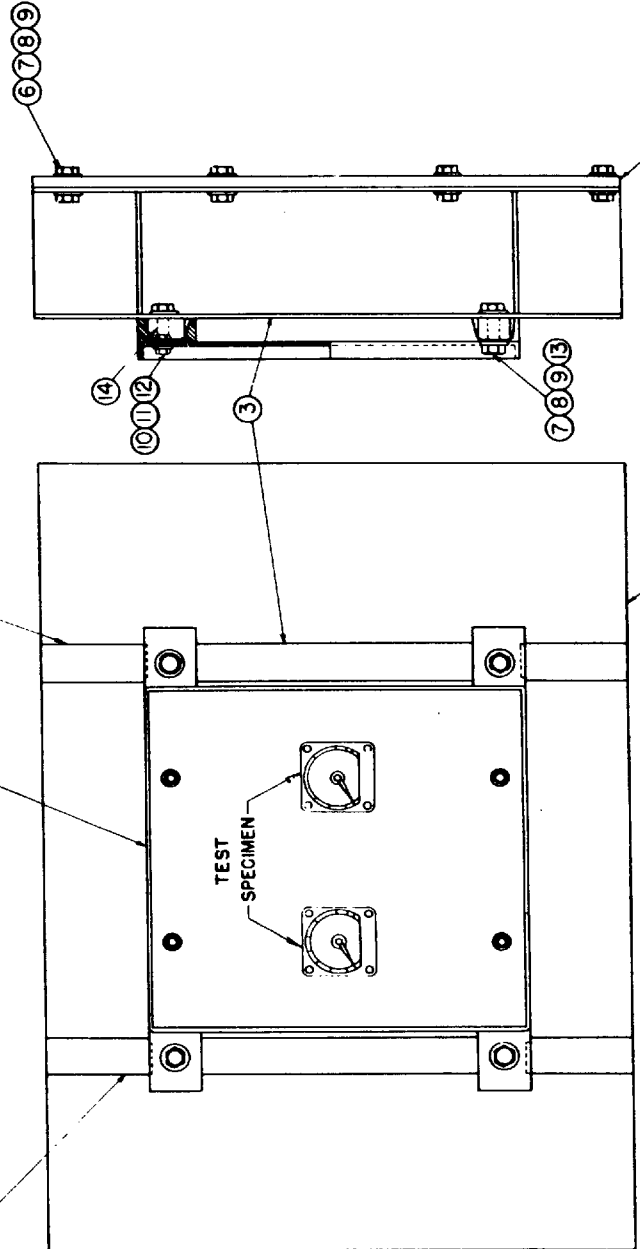
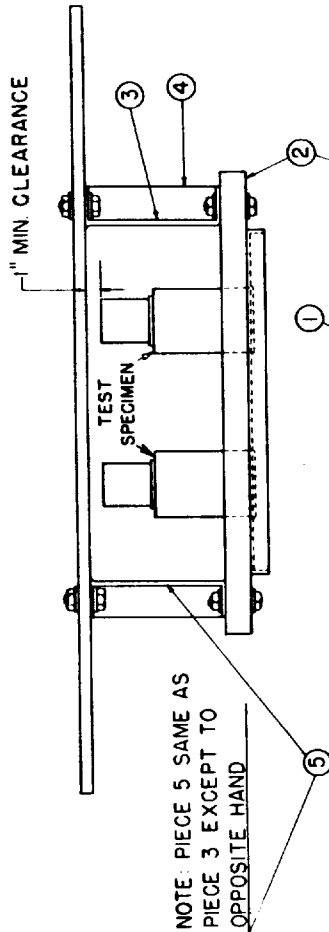
1. THERE ARE 3 MOUNTING PLATFORMS. MOUNTING PLATFORM NO. 3 SHALL BE SIMILAR TO MOUNTING PLATFORM NO. 2 EXCEPT THAT THE DEPTH OF THE HORIZONTAL MOUNTING PLATE AND THE SIDE GUSSET PLATES SHOULD BE INCREASED TO 22 INCHES.
2. THE SMALLEST MTG. PLATFORM SHOULD BE SELECTED WHICH WILL SATISFACTORILY ACCOMMODATE THE EQUIPMENT.
3. IF THE DEEP GUSSETS INTERFERE WITH THE MOUNTING EQUIPMENT, THE EXTRA BOLT HOLES SHOULD BE USED IN BOLTING PLATFORM NO. 1 IN THE INVERTED POSITION TO THE FOUR LOWER BOLT HOLES OF THE ANVIL PLATE.

FIGURE 4-C
STANDARD MOUNTING FOR DECK OR
PLATFORM MOUNTED EQUIPMENT
(TYPE "A" TEST LWSM)

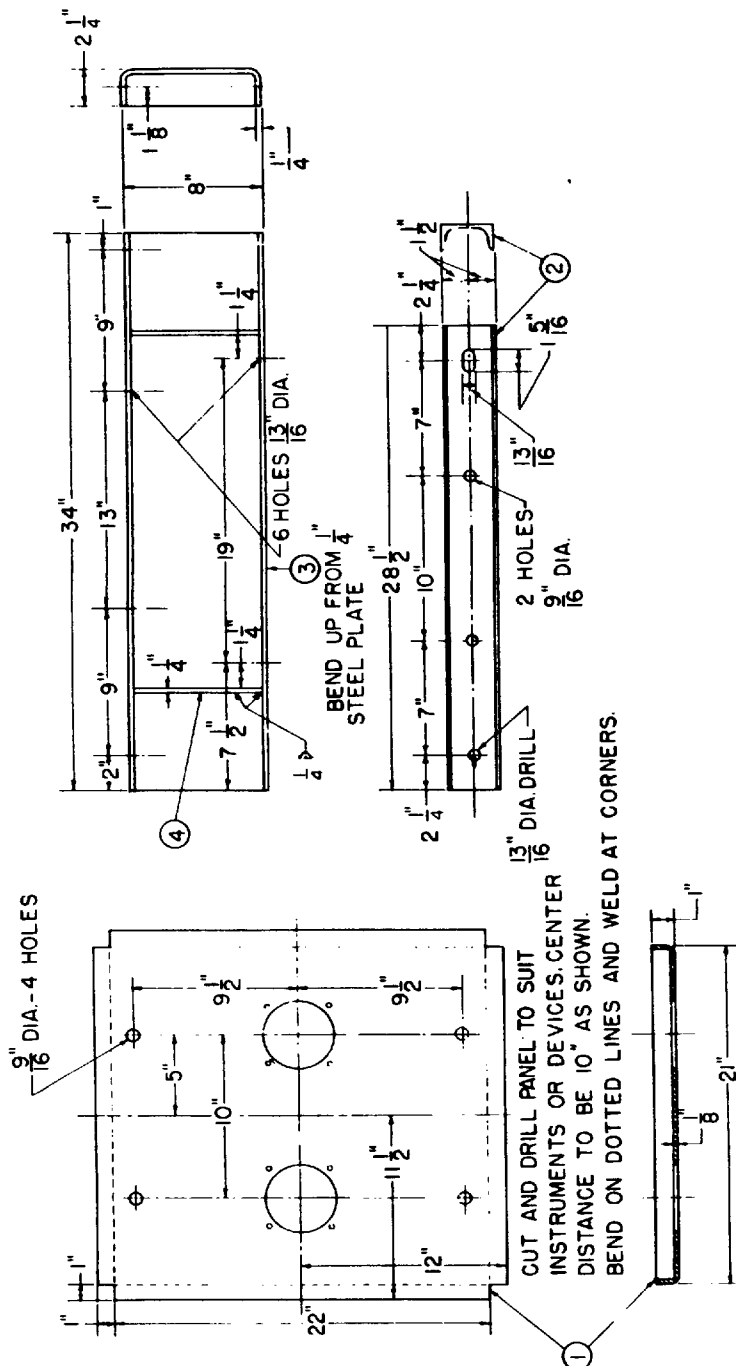
FIGURE 6

TABLE V

LIST OF MATERIALS (SEE NOTE 6)			
QUANTITIES ARE FOR ONE MOUNTING			
PC NO	ITEM	SIZE	NO REQ'D
1	PANEL		1
2	STANDARD PANEL	3" x 5"	2
3	FABRICATED SPACER		1
4	SPACER STIFFENER		4
5	FABRICATED SPACER		1
6	HEX. HD. BOLT	3/4"-10 x 1 3/4"	8
7	HEX. HD. NUT	3/4"-10	12
8	WASHER	2" O.D. x 13/16" I.D.	12
9	WASHER	1 3/8" O.D. x 13/16" I.D.	12
10	HEX. HD. BOLT	1/2"-13 x 1"	4
11	HEX. HD. NUT	1/2"-13	4
12	WASHER	1 3/8" O.D. x 3/16" I.D.	4
13	HEX. HD. BOLT	3/4"-10 x 2 1/2"	4
14	BLOCK	2 1/2" x 2" x 1 1/4"	4



5" PLATE OF MAIN ANVIL PLATE



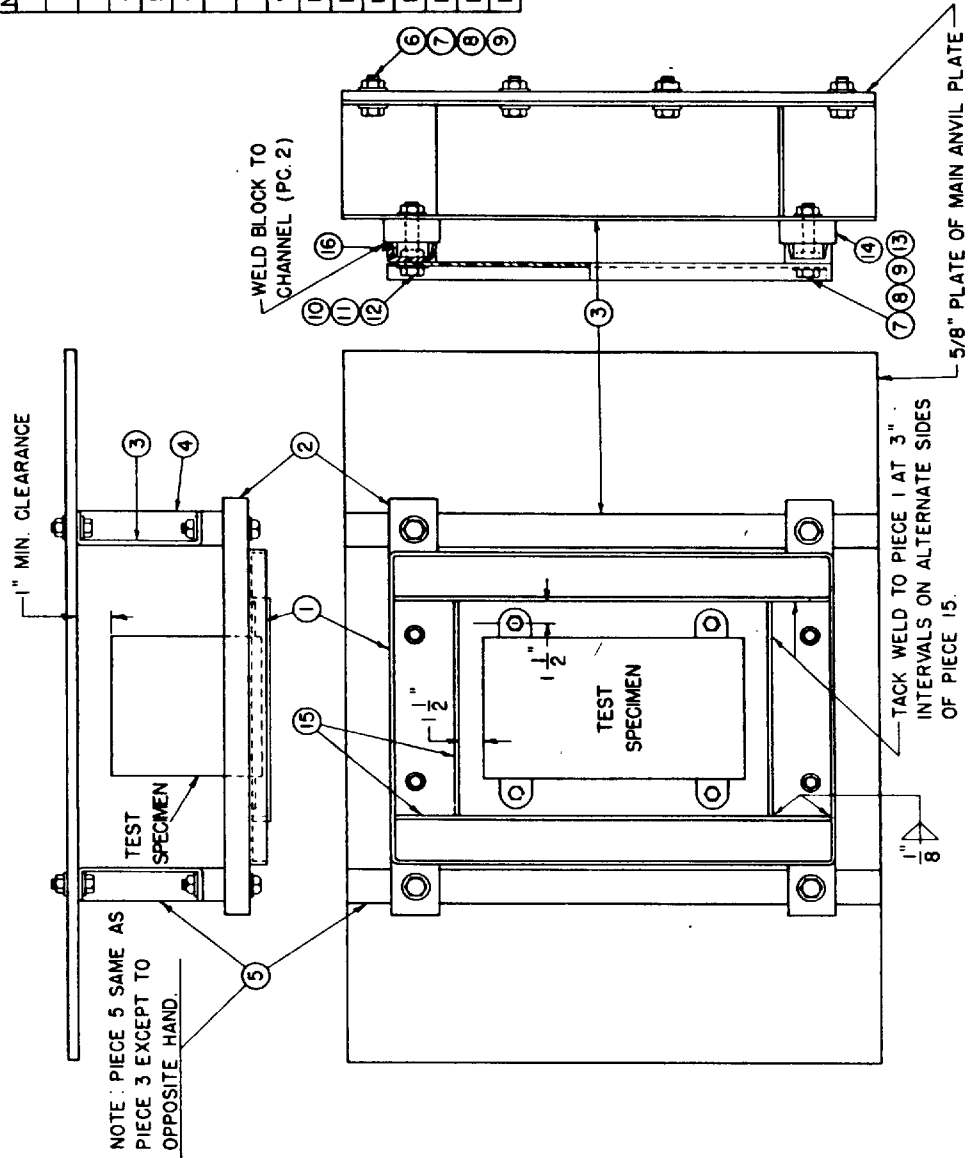
- NOTES:
- 1 TWO IDENTICAL ITEMS OF EQUIPMENT SHALL BE MOUNTED ON THE PANEL PROVIDED THERE IS A MINIMUM SEPARATION OF 3 INCHES WHERE THE INDICATED 10 INCH CENTERS ARE USED (TOTAL WEIGHT NOT TO EXCEED 40 POUNDS)
 - 2 IF ONLY ONE EQUIP IS TO BE TESTED, A COUNTERBALANCE OF APPROXIMATELY THE SAME WEIGHT SHALL BE MOUNTED IN A CORRESPONDING POSITION ON THE OPPOSITE SIDE OF THE PANEL. MOUNTING DIMENSIONS FOR THE COUNTERBALANCE SHALL BE THE SAME AS FOR THE ITEM OF EQUIPMENT
 - 3 IN THE EVENT THAT THE REQUIREMENTS OF NOTES 1 AND 2 CANNOT BE MET, THE EQUIPMENT SHALL BE MOUNTED CENTRALLY ON THE PANEL. IF THE INDIVIDUAL EQUIPMENT WEIGHT IS IN EXCESS OF 20 POUNDS, THE PANEL SHALL BE REINFORCED AS SHOWN ON FIG. 7-2
 - 4 EQUIPMENT IN EXCESS OF 40 POUNDS SHOULD BE TESTED ON THE PANEL SHOWN ON FIG. 7-2
 - 5 IF THE DEPTH OF THE EQUIPMENT IS SUCH THAT THE MINIMUM CLEARANCE OF 1 INCH CANNOT BE MAINTAINED, THE EQUIPMENT SHOULD BE TURNED AROUND SO THAT THE FRONT FACES THE ANVIL PLATE.
 - 6 MATERIAL SHALL BE STEEL.

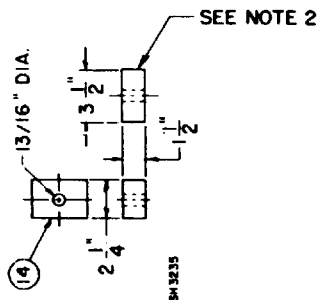
FIGURE 6D-1
STANDARD MOUNTING FOR ELECTRICAL
SWITCHBOARD INSTRUMENTS AND
OTHER PANEL MOUNTED EQUIPMENT
(TYPE "C" TEST LWSM)

FIGURE 7-1

TABLE VI - LIST OF MATERIAL (SEE NOTE 3)

QUANTITIES ARE FOR ONE MOUNTING			
PC. NO.	ITEM	SIZE (INCHES)	NO. REQ.
1	PANEL		1
2	STANDARD CHANNEL	3" X 5.0"	2
3	FABRICATED SPACER		1
4	SPACER STIFFENER		4
5	FABRICATED SPACER		1
6	HEXAGON HEAD BOLT	3/4"-10 X 1-3/4" LG.	8
7	HEXAGON HEAD NUT	3/4"-10	12
8	WASHER	2" O.D. X 13/16" I.D.	12
9	WASHER	1-3/8" O.D. X 13/16" I.D.	12
10	HEXAGON HEAD BOLT	1/2"-13 X 1" LG.	4
11	HEXAGON HEAD NUT	1/2"-13	4
12	WASHER	1-3/8" O.D. X 9/16" I.D.	4
13	HEXAGON HEAD BOLT	3/4"-10 X 4" LG.	4
14	SPACER		4
15	STRAP	1/8" X 1"	4
16	BLOCK	2-1/4" X 2" X 1-1/4"	4





3. MATERIAL SHALL BE STEEL.

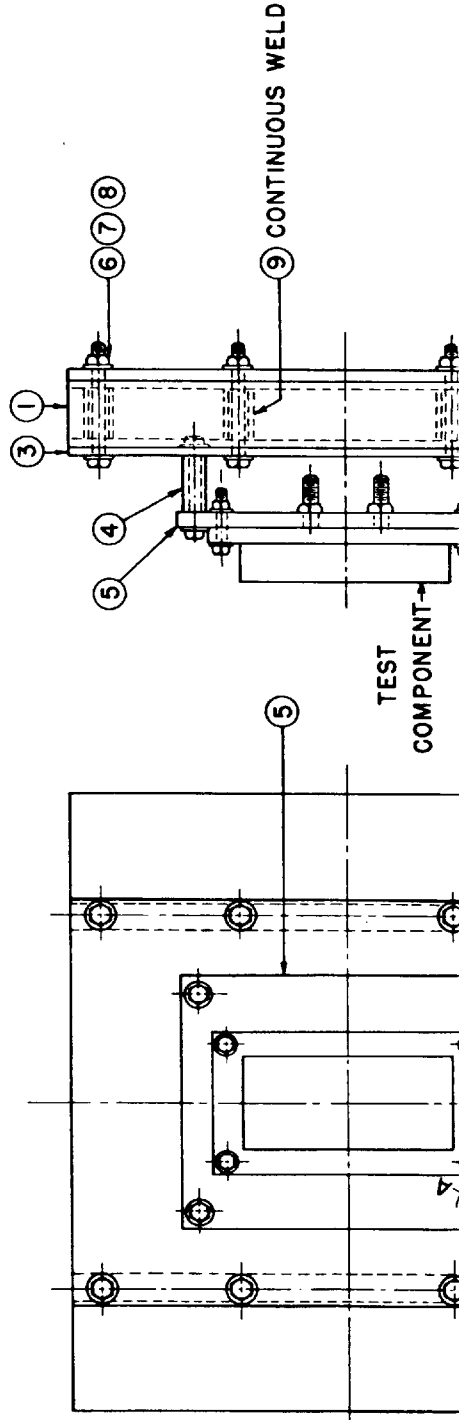
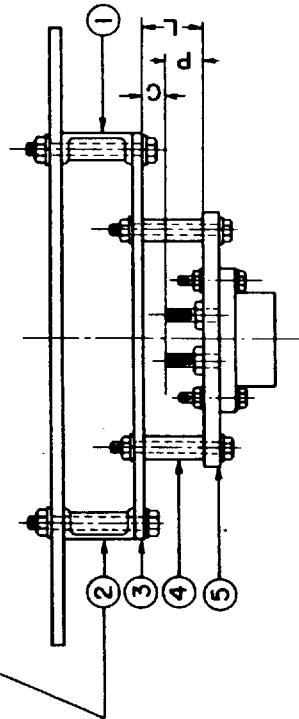
FIGURE 7-2

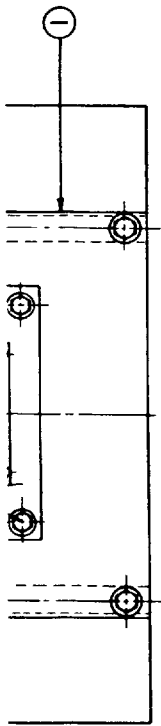
TABLE VII - LIST OF MATERIAL

QUANTITIES ARE FOR ONE MOUNTING				
PIECE NO.	ITEM	SIZE	NO. REQ'D	MATERIAL
1	CAR BUILDING CHANNEL	INCHES 4 BY 13.8 #	1	STEEL
2	CAR BUILDING CHANNEL	4 BY 13.8 #	1	STEEL
3	AUXILIARY PLATE	$\frac{1}{2}$ BY 27 BY 34	1	STEEL
4	SPACER	SEE TABLE VIII	—	STEEL
5	PLASTIC MOUNTING PANEL	SEE TABLE IX	—	LAMINATED (MIL-P-15035)
6	HEXAGON HEAD BOLT	$\frac{3}{4}$ - 10 BY 7 LG.	8	STEEL (HEAT-TREATED)
7	HEXAGON HEAD NUT	$\frac{3}{4}$ - 10	8	STEEL
8	WASHER	2 O.D. BY $\frac{13}{16}$ I.D.	16	STEEL
9	STANDARD PIPE SPACER	1" IPS x 2 $\frac{5}{8}$ LG.	8	STEEL

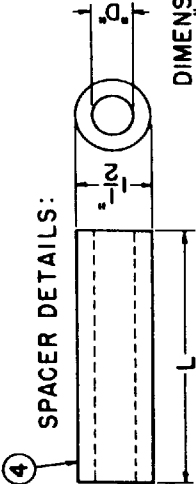
THE SIZE OF THE AUXILIARY PLATE SHOULD BE INCREASED TO $\frac{1}{2}$ BY 36 BY 34 INCHES FOR PANEL NUMBERS 5 AND 6 LISTED IN TABLE IX

SAME AS PG. I EXCEPT
TO OPPOSITE HAND.





DIMENSION "A", AS MEASURED FROM THE CENTER OF ANY MOUNTING HOLE OF PG. 5 TO THE COMPONENT MOUNTING BASE, SHALL BE NOT LESS THAN 2 1/2 INCHES.



DIMENSION "D" SHALL BE 17/32 FOR 1/2" DIA. BOLTS AND 21/32 FOR 5/8" DIA. BOLTS.

TABLE VIII - SPACER

WHEN P (NOTE ASSEMBLY PLAN VIEW) IS:		L		NOTES
LESS THAN	GREATER THAN	INCHES	INCHES	
3/4	—	—	1 - 1/2	CUT OUT 1/2 INCH THICK AUXILIARY MOUNTING PLATE (PIECE NO.3) TO GIVE 3/4 INCH CLEARANCE AROUND REAR PROJECTIONS.
3 1/4	3/4	—	P + 3/4	
—	3 1/4	4	4	

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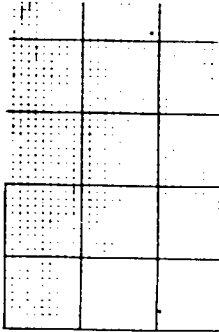
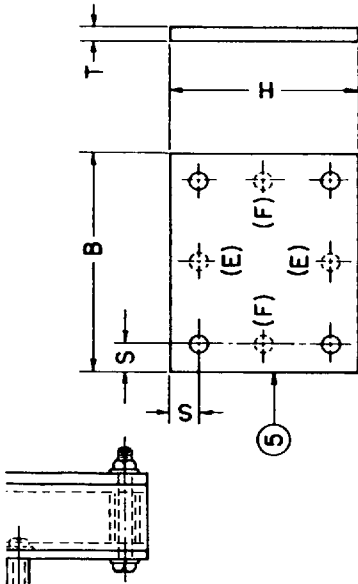


FIGURE 6E
STANDARD MOUNTING FOR ELECTRICAL
CONTROLLER COMPONENTS
(CONTACTORS, RELAYS, RESISTORS, ETC)
(TYPE "C" TEST LWSM)

FIGURE 8

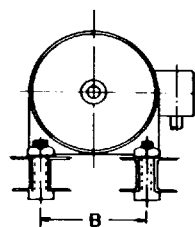
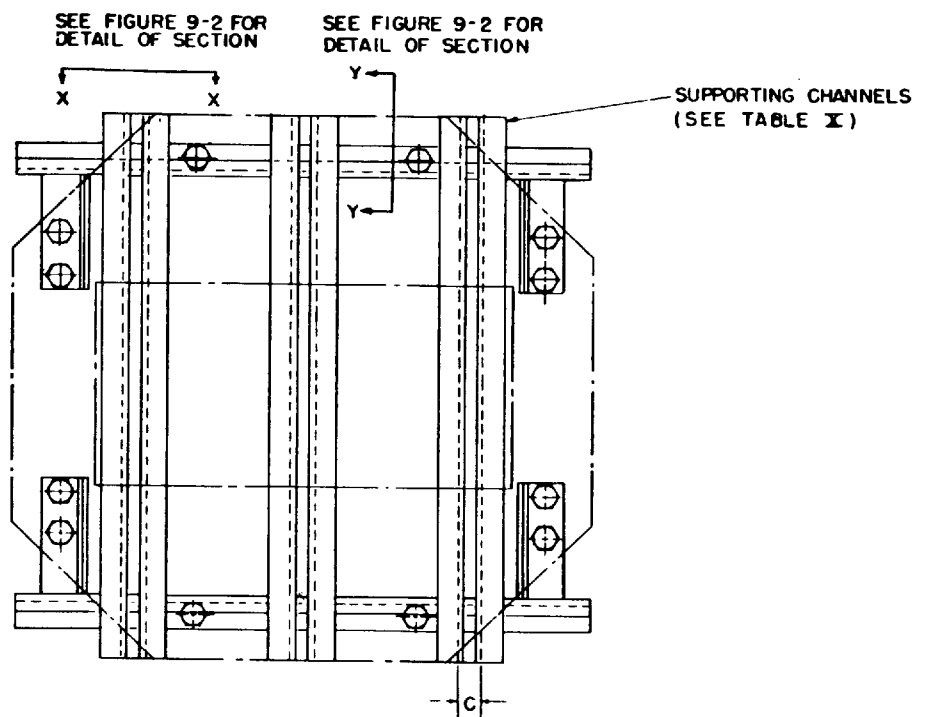


HOLES (E) ARE DRILLED EQUIDISTANT FROM CORNER HOLES ON SAME CENTER LINE-PANEL NO.5 AND 6 ONLY. HOLES (F) ARE DRILLED EQUIDISTANT FROM CORNER HOLES ON SAME CENTER LINE-PANEL NO.4 AND 6 ONLY.

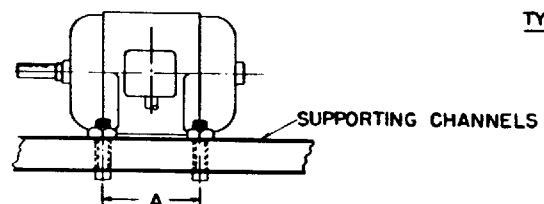
TABLE IX - PANEL SIZE 1 1/2

PANEL NO.	B	H	T	S	NO. AND SIZE OF BOLTS	DIAMETER OF BOLT HOLES
1	9	12	3/4	1	4 1/2 INCHES BY 13	INCHES 9/16
2	12	16	1	1	4 1/2 INCHES BY 13	9/16
3	16	20	1	1	4 1/2 INCHES BY 13	9/16
4	20	24	1	1	6 1/2 INCHES BY 13	9/16
5	32	24	1	1 1/4	5 INCHES BY 11	11/16
6	36	34	1	1 1/4	5 INCHES BY 11	11/16

1. THE PANEL EMPLOYED SHALL BE THE SMALLEST SIZE SHOWN THAT WILL RESULT IN CLEARANCE (NOTE ASSEMBLY FRONT ELEVATION VIEW) OF AT LEAST 2 1/2 INCHES.
2. THE MANUFACTURER IS TO PROVIDE THE APPROPRIATE PANEL, TOGETHER WITH ALL SPACERS AND MOUNTING FOR BOLTS, WHEN SUBMITTING A COMPONENT TO A NAVAL LABORATORY FOR TEST.

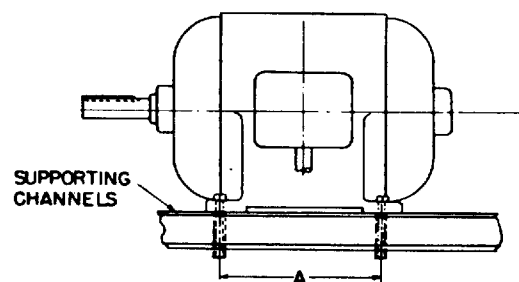
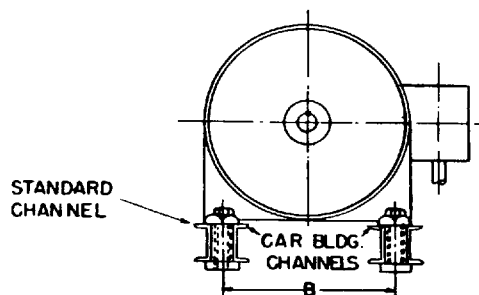


CASE 1

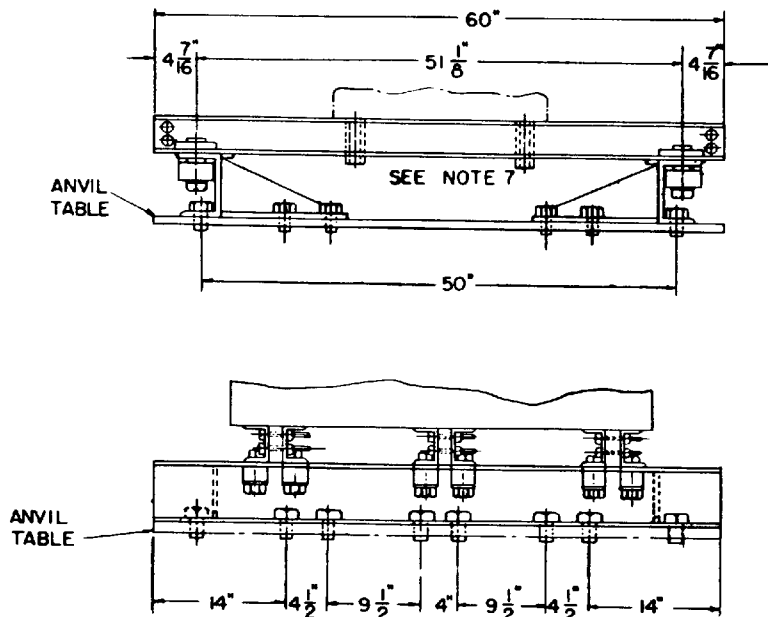


TYPICAL MOUNTING 1

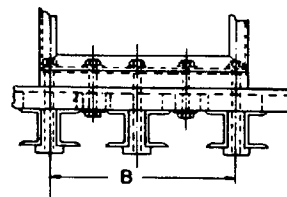
FOR EQUIPMENT REQUIRING TWICE THE NUMBER OF SUPPORTING CHANNELS
AS THE NUMBER OF PARALLEL LINES OF MOUNTING BOLT HOLES.



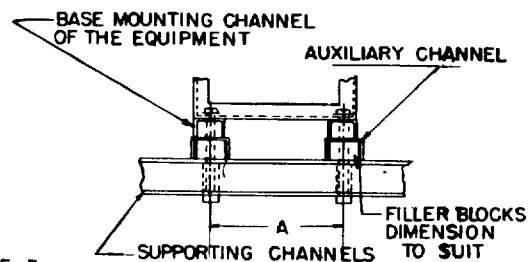
CASE 2
(SEE NOTE-10)



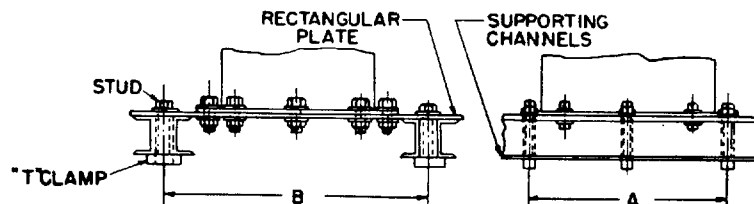
RANGEMENTS



CASE 3



FOR EQUIPMENT REQUIRING FULL SUPPORT
ALONG ENTIRE BASE



CASE 4
(SEE NOTE-11)

NOTES:

- 1 DIMENSIONS 'A' AND CENTER DISTANCE DIMENSION 'B' ALWAYS DIMENSION 'A'
- 2 THE APPROPRIATE SHALL BE SELECTED WEIGHT AND DIMENSION (SEE TABLE X)
- 3 WHEN SELECTING WEIGHT AND DIMENSION THE NEXT HIGHER DIMENSION 'A' SHALL BE USED
- 4 WHEN SELECTING CASES 3 AND 4 OF THE AUXILIARY CHANNELS INCLUDED IN THE
- 5 TWO STANDARD 4 BINED STRENGTH 13.8" CAR BUILDING PLACE OF, OR IN CHANNELS.
- 6 WHEN USING STANDARDS BACK THE ENDS OF WITH THE SPACER, P
- 7 HOLES SHOULD NOT SUPPORTING CHANNELS. EQUIPMENT SHALL BE MEAN
- 8 THE SPACING OF THE CHANNELS SHOULD BE POSITION OF THE CENTER DISTRIBUTION OF LOAD.
- 9 IF THE EQUIPMENT MORE THAN DIMENSION 'C', THE FEET AND SUPPORT AND CLAMP.
- 10 FOR EQUIPMENT REQUIRING CHANNELS, ALL OR PART CHANNELS AS INDICATED STANDARD CHANNELS ARRANGEMENT- NOTE NUMBER OF SUPPORT TO THIS METHOD, THE CASE 3 SHOULD BE
- 11 FOR EQUIPMENT HAVING HOLE PATTERN (UTILIZED TO PROVIDE TOTAL BASE GREATER THAN PROVIDED)

TABLE X: NUMBER OF SUPPORTING 4" CAR BUILDING CHANNELS
REQUIRED FOR A GIVEN EQUIPMENT WEIGHT & SIZE

'B' ARE THE EXTREME BOLT HOLE
OF THE EQUIPMENT WITH DIMEN-
SUAL TO OR GREATER THAN DIMEN-

NUMBER OF SUPPORTING CHANNELS
D IN ACCORDANCE WITH THE
SION 'A' OF THE EQUIPMENT.

SUPPORTING CHANNELS FOR
SION 'A' NOT LISTED IN TABLE X
WEIGHT VALUE AND THE SMALLER
L BE USED.

HE SUPPORTING CHANNELS FOR
LISTED IN TABLE X, THE WEIGHT
CHANNELS OR PLATES SHOULD BE
EQUIPMENT WEIGHT.

BY 7.25" CHANNELS HAVE A COM-
EQUIVALENT TO A SINGLE 4" BY
CHANNEL AND MAY BE USED IN
JUNCTION WITH, THE CAR BUILDING

) OR CAR BUILDING CHANNELS BACK TO
HE CHANNELS SHOULD BE CLAMPED
3, AND BOLTS SHOWN ON FIGURE 9-2.

: DRILLED THROUGH THE FLANGES OF THE
S FOR THE PURPOSE OF BOLTING EQUIP-
OULD BE BOLTED TO THE SUPPORTING
OF THE T CLAMP SHOWN ON FIGURE 9-2.

UPPORTING CHANNELS ON THE SHIPBUILDING
GOVERNED ,WHEN PRACTICABLE, BY THE
ER OF GRAVITY TO OBTAIN UNIFORM DIS-

NTING FEET ARE NOT SUBSTANTIALLY WIDER
STEEL PAD SHOULD BE USED BETWEEN
ING CHANNELS AT EACH MOUNTING BOLT

RING TWO OR MORE CAR BUILDING SUPPORTING
T OF THE NUMBER OF CAR BUILDING
D IN TABLE X MAY BE REPLACED WITH
TO UTILIZE A BACK TO BACK CHANNEL
IN THE EVENT THAT THE REQUIRED
G CHANNELS DOES NOT LEND ITSELF
UXILIARY CHANNEL ARRANGEMENT OF
ED.

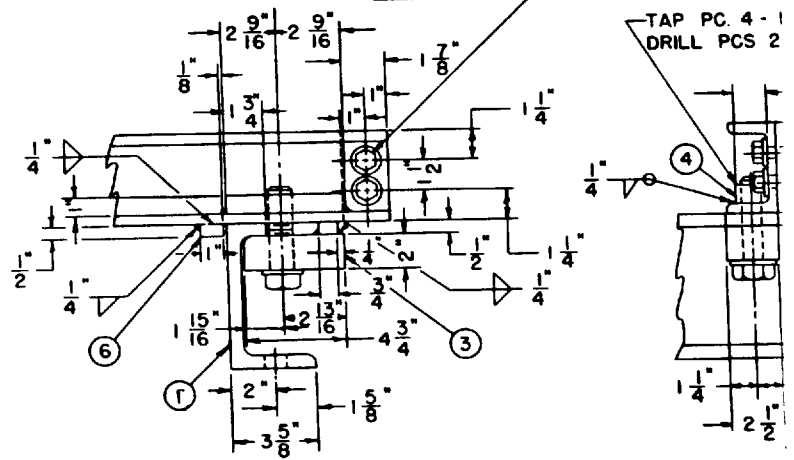
AN IRREGULAR OR CIRCULAR MOUNTING BOLT
T"CLAMPS OF SUFFICIENT SIZE AND NUMBER
RING STRENGTH AT LEAST 50 PERCENT
D BY EQUIPMENT BOLTS.)

WEIGHT OF EQUIPMENT (SEE NOTE 4) LBS	CENTER DISTANCE BETWEEN BOLT HOLES DIMENSION "A" (INCHES)															
	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
500	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
600	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
700	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2
800	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2
900	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2
1000	4	4	3	3	3	3	2	2	2	2	2	2	2	2	2	2
1100	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	2
1200	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2
1300	5	5	4	4	4	4	3	3	3	2	2	2	2	2	2	2
1400	5	5	5	4	4	4	4	3	3	3	2	2	2	2	2	2
1500	5	5	5	5	4	4	4	3	3	3	3	2	2	2	2	2
1600	6	5	5	5	4	4	4	4	3	3	3	3	2	2	2	2
1700	6	6	6	5	5	4	4	4	4	3	3	3	3	3	3	3
1800	6	6	6	6	5	5	5	4	4	4	3	3	3	3	3	3
1900	7	6	6	6	6	5	5	5	4	4	4	3	3	3	3	3
2000	7	7	6	6	6	5	5	5	4	4	4	4	3	3	3	3
2100	7	7	7	6	6	6	5	5	4	4	4	4	3	3	3	3
2200	8	7	7	7	6	6	6	5	5	4	4	4	3	3	3	3
2300	8	8	7	7	7	6	6	5	5	4	4	4	3	3	3	3
2400	8	8	8	7	7	6	6	5	5	4	4	4	3	3	3	3
2500	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
2600	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
2700	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
2800	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
2900	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3000	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3100	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3200	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3300	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3400	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3500	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3600	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3700	8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3800	9	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
3900	9	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4
4000	9	8	8	7	7	6	6	5	5	4	4	4	4	4	4	4
4100	9	8	8	7	7	6	6	6	6	6	6	6	6	6	6	6
4200	9	9	8	7	7	6	6	6	6	6	6	6	6	6	6	6
4300	10	9	8	7	7	6	6	6	6	6	6	6	6	6	6	6
4400	10	9	8	8	7	6	6	6	6	6	6	6	6	6	6	6
4500	10	9	9	8	7	6	6	6	6	6	6	6	6	6	6	6
4600	10	9	9	8	7	7	6	6	6	6	6	6	6	6	6	6
4700	10	9	9	8	7	7	6	6	6	6	6	6	6	6	6	6
4800	10	9	8	8	7	6	6	6	6	6	6	6	6	6	6	6
4900	10	9	8	8	7	7	7	7	7	7	7	7	7	7	7	7
5000	10	9	8	8	7	7	7	7	7	7	7	7	7	7	7	7
5100	10	10	9	8	7	7	7	7	7	7	7	7	7	7	7	7
5200	10	10	9	8	8	7	7	7	7	7	7	7	7	7	7	7
5300	10	9	8	8	7	7	7	7	7	7	7	7	7	7	7	7
5400	10	9	9	8	7	7	7	7	7	7	7	7	7	7	7	7
5500	10	9	9	8	7	7	7	7	7	7	7	7	7	7	7	7
5600	10	9	9	8	8	7	7	7	7	7	7	7	7	7	7	7
5700	10	9	9	9	8	8	8	8	8	8	8	8	8	8	8	8
5800	10	9	9	9	8	8	8	8	8	8	8	8	8	8	8	8
5900	10	9	9	9	8	8	8	8	8	8	8	8	8	8	8	8
6000	10	10	9	9	8	8	8	8	8	8	8	8	8	8	8	8

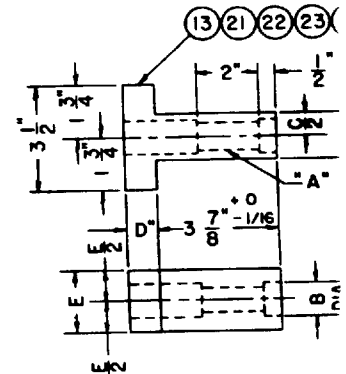
FIGURE 9-1
STANDARD MOUNTING PLATFORM
FOR TESTING EQUIPMENT ON
MEDIUM WEIGHT SHOCK TESTING
MACHINE.



-TAP PC. 4 - 1
DRILL PCS 2



SECTION

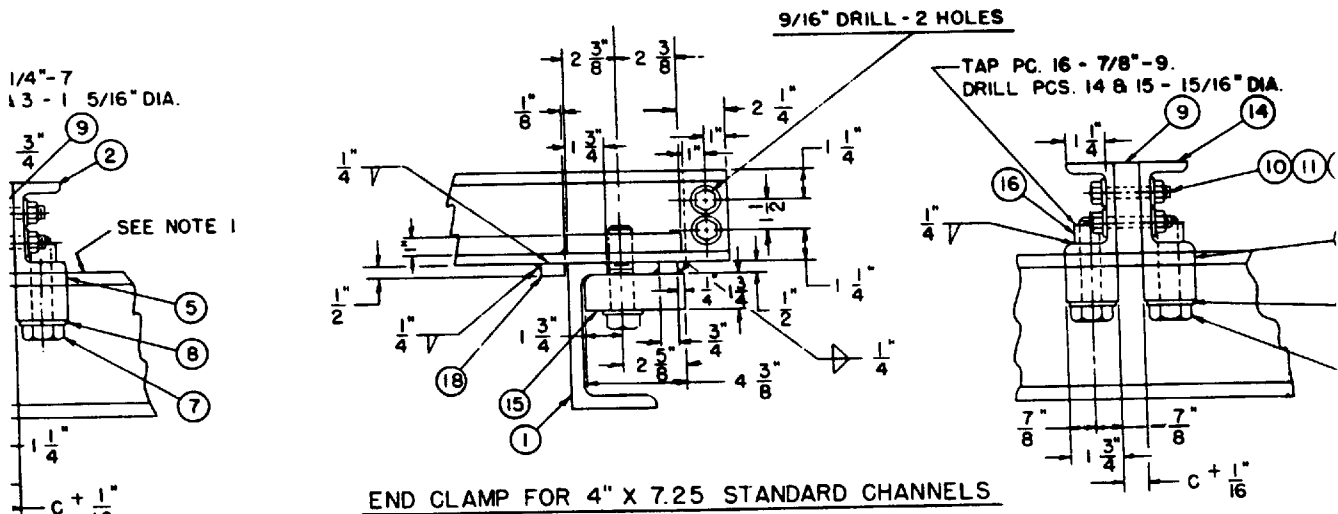


PC. NO.	A	B	C
13	1/2" - 13	9/16"	1 1/8"
21	5/8" - 11	11/16"	1 1/8"
22	3/4" - 10	13/16"	1 1/4"
23	7/8" - 9	15/16"	1 3/8"
24	1" - 8	1 1/16"	1 1/2"

Technical drawing of a mechanical part with the following dimensions and labels:

- 1-1/16" DRILL - 2 HOLES
- 25
- 1/2"
- 5 1/4"
- 1/2"
- 1/2"
- 1/2"
- 4 1/2"
- 6 1/2"
- 13"
- 4 1/2"
- 1 1/2"
- 2 1/2"
- 4"

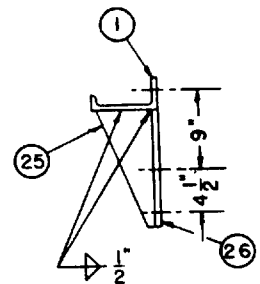
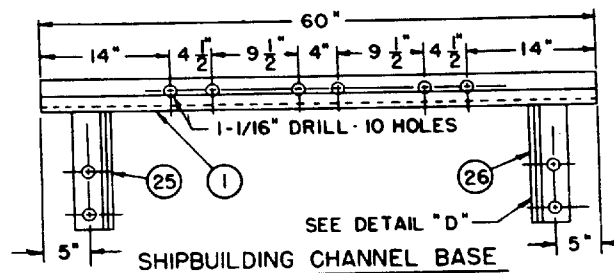
DETAIL OF BRACE FOR SHIPBUILDING CHANNEL



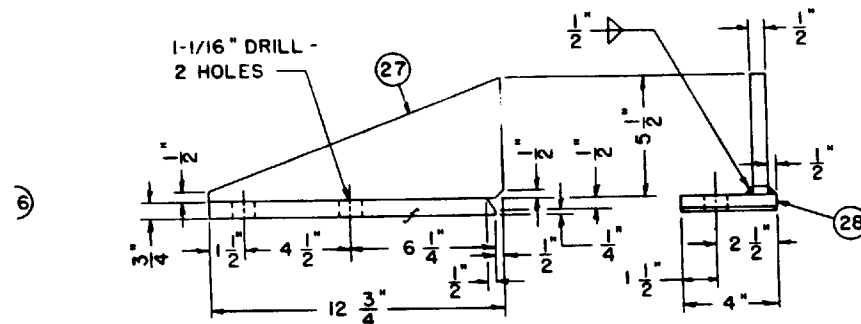
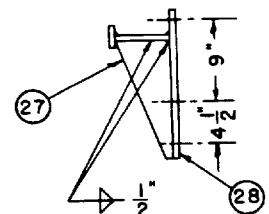
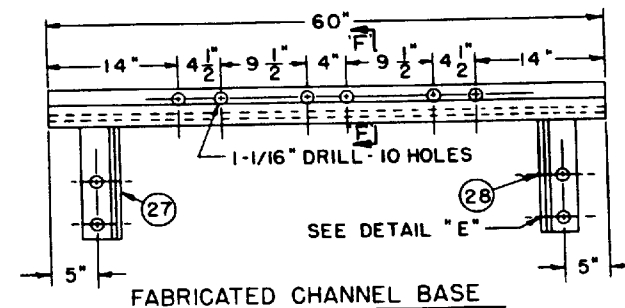
X-X
CHANNELS

1) "T" CLAMP - USED TO
SECURE EQUIPMENT TO
SUPPORTING CHANNELS

AP SIZE



D	E
4"	1 1/8"
4"	1 1/8"
8"	1 1/2"
1/16"	3/4"
1"	2"



DETAIL OF BRACE FOR FABRICATED CHANNEL

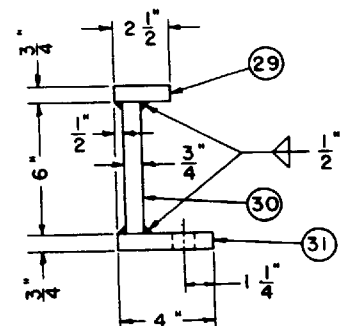


TABLE XI - LIST OF MATERIAL ✓

PC NO.	ITEM	SIZE (INCHES)	NO. REQ.
1	SHIPBUILDING CHANNEL	7 X 22.7*	2
2	CARBUILDING CHANNEL	4 X 13.8 *	A/R
3	CLAMP	2"X2 1/2" X 4 3/4"	A/R
4	BLOCK	1" X 1 3/4" X 5 1/8"	A/R
5	PAD	1/2"X3/4" X 2 1/2"	A/R
6	PAD	1/2"X 1" X 2"	A/R
7	HEXAGON HEAD BOLT	1 1/4"-7 X 4 1/4" LG.	A/R
8	WASHER	1 3/8" I.D. X 2 5/16" O.D.	A/R
9	SPACER	2" X 4" X A/R	A/R
10	HEXAGON HEAD BOLT	1/2"-13 X A/R	A/R
11	WASHER	9/16" I.D. X 1" O.D.	A/R
12	HEXAGON HEAD NUT	1/2"-13	A/R
13	CLAMP	SEE TABLE XII	A/R
14	STANDARD CHANNEL	4" X 7.25*	A/R
15	CLAMP	1 3/4" X 1 3/4" X 4 3/8"	A/R
16	BLOCK	1" X 1 1/4" X 4 3/4"	A/R
17	PAD	1/2" X 3/4" X 1 3/4"	A/R
18	PAD	1/2" X 1" X 1 1/4"	A/R
19	HEXAGON HEAD BOLT	7/8"-9 X 3 5/8" LG.	A/R
20	WASHER	15/16" I.D. X 1 9/16" O.D.	A/R
21	CLAMP	SEE TABLE XII	A/R
22	CLAMP	SEE TABLE XII	A/R
23	CLAMP	SEE TABLE XII	A/R
24	CLAMP	SEE TABLE XII	A/R
25	GUSSET	1/2" X 5 1/4" X 13"	A/R
26	PLATE	3/4" X 4" X 13"	A/R
27	GUSSET	1/2" X 5 1/2" X 12 3/4"	A/R
28	PLATE	7/8" X 4" X 12 1/4"	A/R
29	PLATE	7/8" X 2 1/2" X 60"	A/R
30	PLATE	3/4" X 6" X 60"	A/R
31	PLATE	7/8" X 4" X 60"	A/R

✓ MATERIAL SHALL BE STEEL

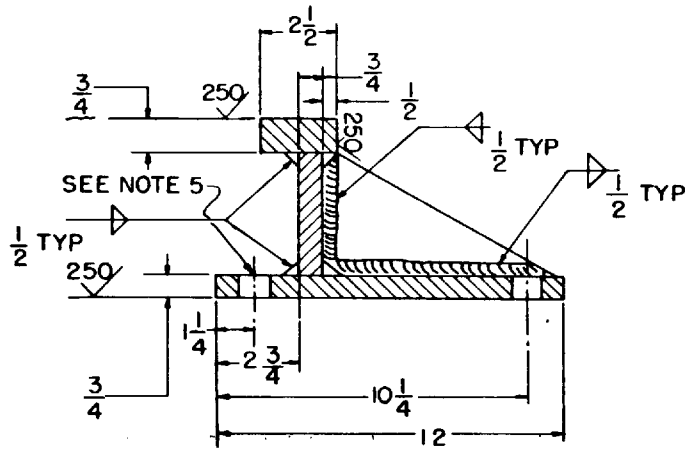
NOTES:

1. TOP FLANGE OF PC. NO. 1 SHALL BE BURNED OR CUT OFF TO A WIDTH OF 1 3/4"
2. PC. NOS. 3 AND 4 SHALL BE SHAPED TO FIT INNER SURFACES OF PC. NOS. 1 AND 2 RESPECTIVELY. (SEE NOTE 5)
3. PC. NOS. 15 AND 16 SHALL BE SHAPED TO FIT INNER SURFACES OF PC. NOS. 1 AND 14 RESPECTIVELY. (SEE NOTE 5)
4. USE OF EITHER PC. NO. 1 OR THE FABRICATED CHANNEL, SECTION "F-F" OF FIG. 9-2 IS OPTIONAL DEPENDENT UPON AVAILABILITY OF MATERIAL OR EASE OF FABRICATION.
5. IF THE FABRICATED CHANNEL, SECTION "F-F" IS USED, PC. NOS. 3 AND 15 SHOULD BE SHAPED TO FIT THE INNER SURFACE OF THE FABRICATED CHANNEL, SECTION "F-F", RATHER THAN PC. NO. 1. PC. NOS. 6 AND 18 SHALL EACH BE SHIFTED INWARD 3/4".
6. USE OF BACK TO BACK SUPPORTING CHANNELS WHICH ARE PERMANENTLY WELDED TOGETHER AT THE ENDS RATHER THAN BOLTED TOGETHER, IS OPTIONAL.

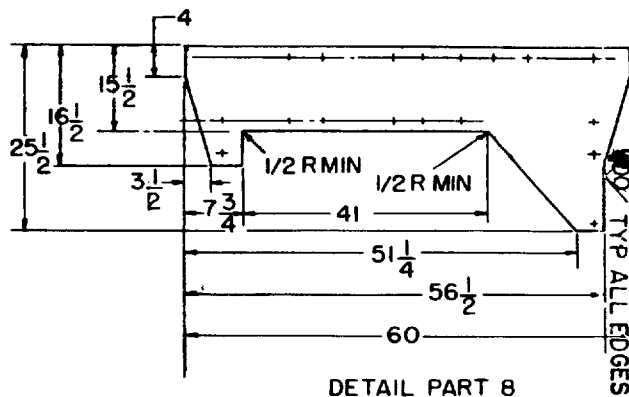
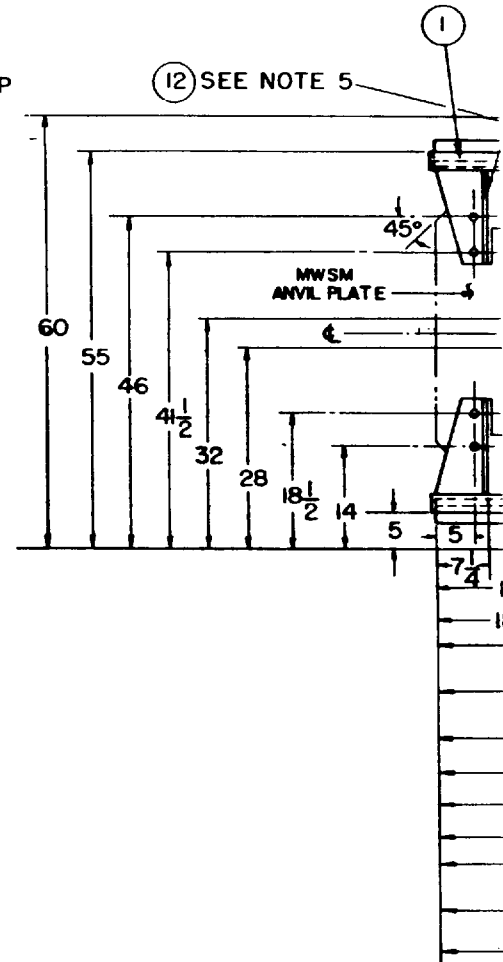
FIGURE 9-2

STANDARD MOUNTING PLATFORM FOR
TESTING EQUIPMENT ON MEDIUM
WEIGHT SHOCK TESTING MACHINE





SECTION A-A



DETAIL PART 8

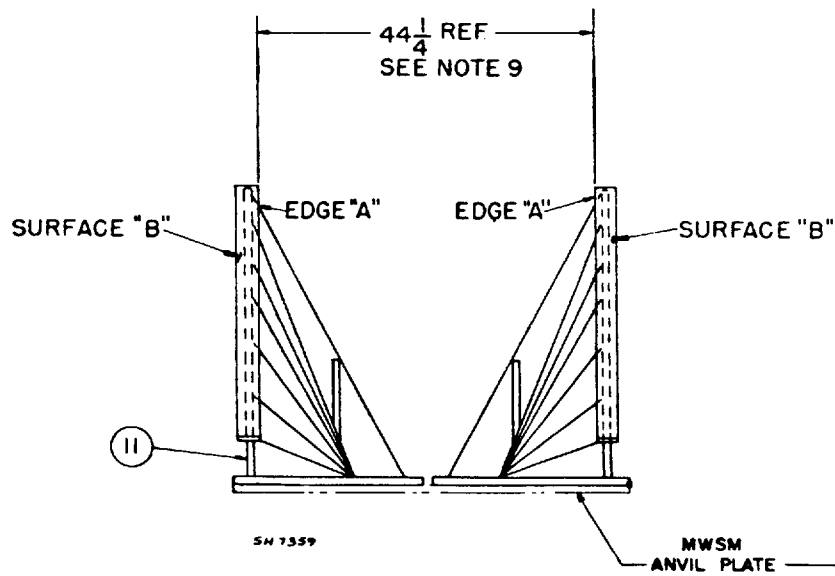
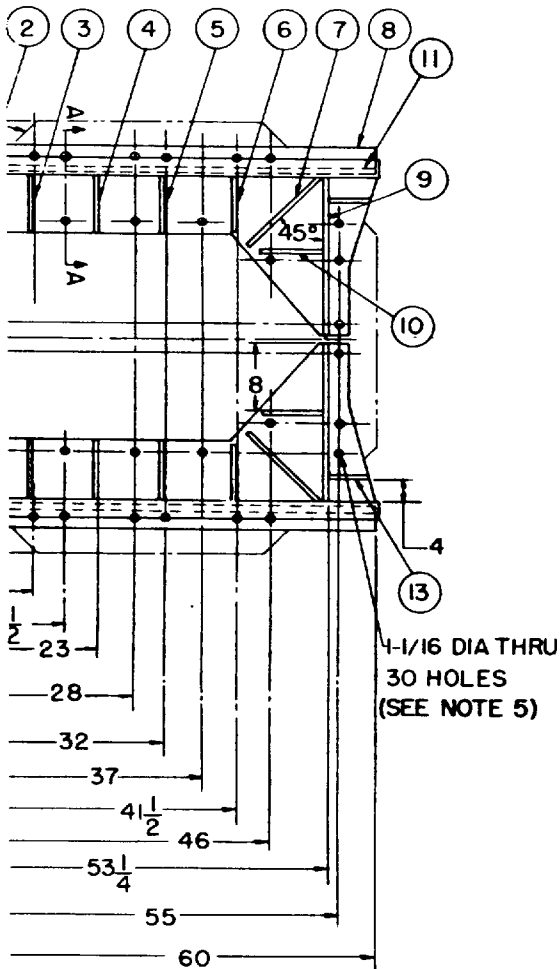


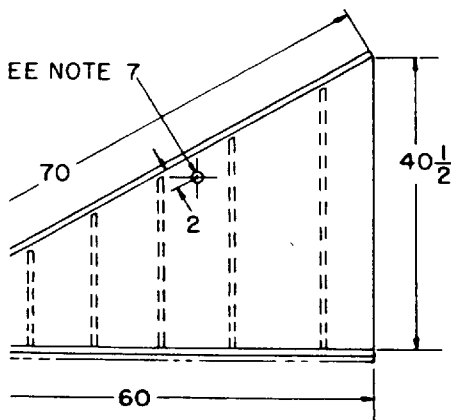
TABLE XIII-LIST OF MATERIALS

PIECE NO.	SIZE	MATERIAL	NO. REQUIRED
1	1 X 4 X 70	HRS 1010	2
2	1/2 X 9 X 12-1/2		2
3	1/2 X 8 X 13-1/2		2
4	1/2 X 8 X 18-1/2		2
5	1/2 X 8 X 29-1/2		2
6	1/2 X 8 X 29		2
7	1/2 X 22 X 36		2
8	1 X 52 X 60		2
9	1/2 X 22 X 36		2
10	1/2 X 7 X 6-1/2		2
11	3/4 X 60 X 40-1/2	HRS 1010	2
12	1/4 X 30 X 60	61 ST	2
13	1/2 X 5 X 27	HRS 1010	2



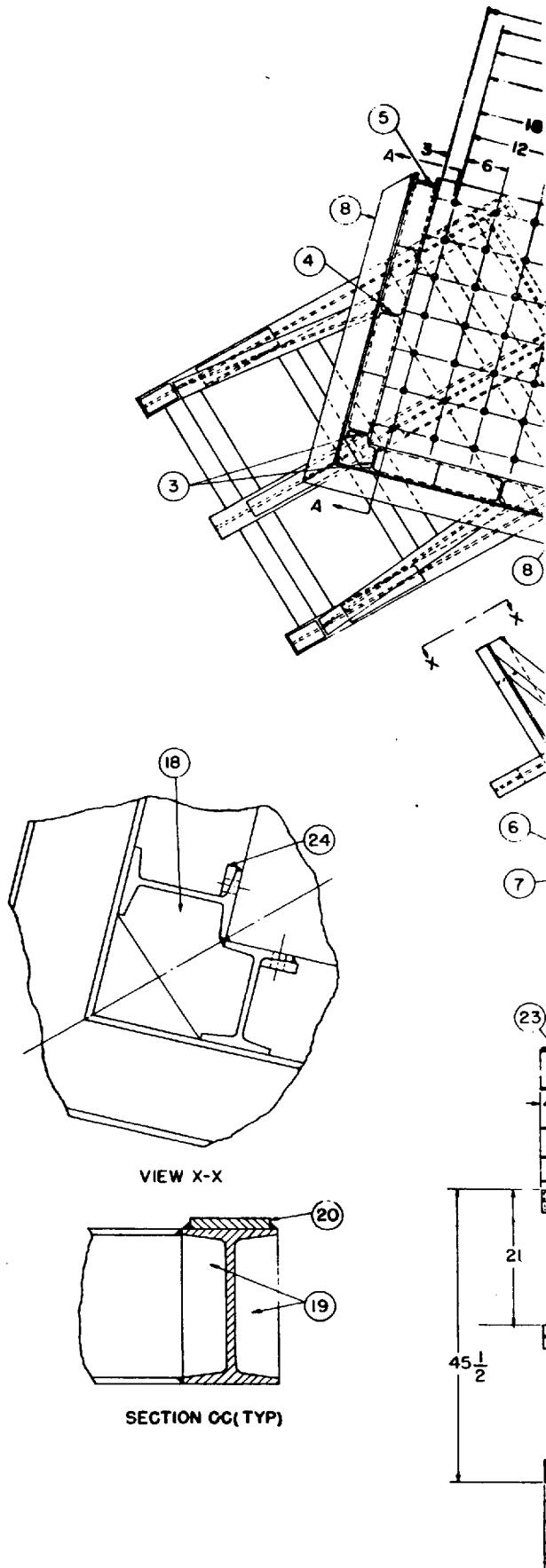
NOTES:

1. THIS FIXTURE WHEN USED, REPLACES THE SHIPBUILDING OR FABRICATED CHANNELS SHOWN ON FIGURES 9-1 & 9-2. EQUIPMENT AND SUPPORTING CHANNELS ARE MOUNTED TO THIS FIXTURE AS SHOWN ON FIGURE 9-1.
2. SEE FIGURE 10-2 FOR 30 DEGREE MOUNTING PLATFORM FOR BULKHEAD SUPPORTED EQUIPMENT.
3. FULLY ANNEAL ASSEMBLY AFTER WELDING.
4. FINISH MACHINE AFTER ANNEALING.
5. PIECE NO. 12 IS NOT A PART OF THE FIXTURE. IT IS A TEMPLATE HAVING A HOLE PATTERN IDENTICAL TO THE H.I. SHOCK TEST MACHINE PLATFORM. LOCATE ALL 1-1/16" DIA. HOLES FROM SHOCK MACHINE PLATFORM.
6. ALL WELDS TO BE 1/2 INCH COMPLETELY AROUND EACH EDGE
7. TWO INCH DIAMETER HOLE SHALL BE TORCH CUT AFTER WELDING. THE HOLE SHALL BE LOCATED NEAR THE CENTER OF GRAVITY.
8. ALL EDGES AND CORNERS SHALL BE BROKEN SUITABLE FOR HANDLING.
9. PARALLELISM SHALL BE MAINTAINED AT SURFACES "B" AND EDGES "A" WITHIN 1/32 INCH.



30° MOUNTING FIXTURE FOR TESTING
BASE MOUNTED EQUIPMENT ON
MEDIUM WEIGHT SHOCK TESTING
MACHINE.

FIGURE 10-1



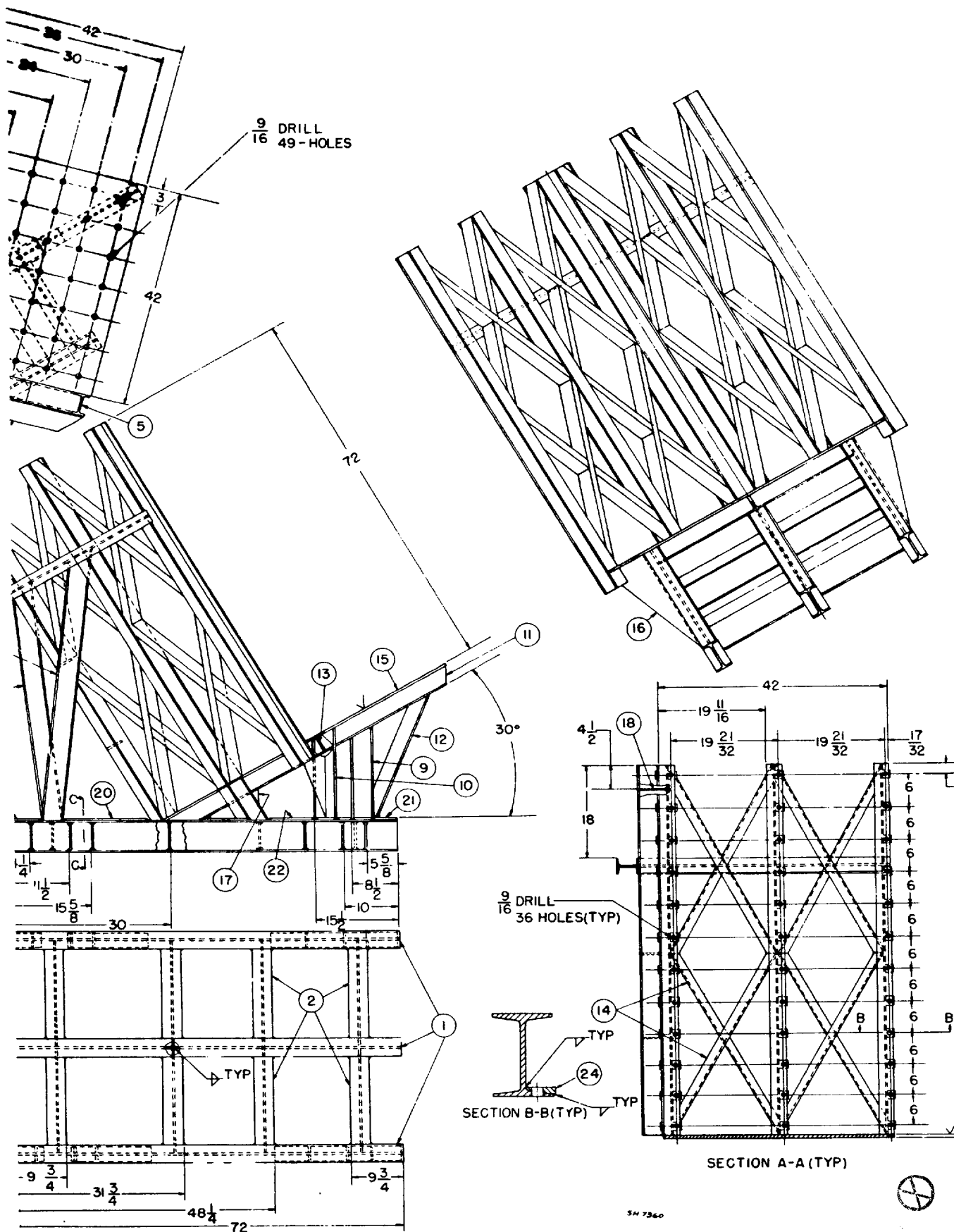


TABLE XIV LIST OF MATERIAL V, 2

PIECE NO	ITEM	SIZE INCHES	LENGTH INCHES	NO REQUIRED
1	H-BEAM	60 X 3-1/2 X 0.25 WEB	72	3
2	H-BEAM	60 X 3-1/2 X 0.25 WEB	20-3/4	8
3	H-BEAM	40 X 2-5/8 X 0.25 WEB	74	2
4	H-BEAM	40 X 2-5/8 X 0.25 WEB	82	2
5	H-BEAM	40 X 2-5/8 X 0.25 WEB	75	2
6	H-BEAM	40 X 2-5/8 X 0.25 WEB	52	2
7	H-BEAM	40 X 2-5/8 X 0.25 WEB	45	1
8	H-BEAM	40 X 2-5/8 X 0.25 WEB	50	2
9	H-BEAM	40 X 2-5/8 X 0.25 WEB	17-1/2	1
10	H-BEAM	40 X 2-5/8 X 0.25 WEB	16-3/4	2
11	T-BEAM	30 X 30 X 0.25 WEB	59	1
12	T-BEAM	30 X 30 X 0.25 WEB	24-3/4	1
13	T-BEAM	30 X 30 X 0.25 WEB	20-3/4	2
14	CHANNEL	40 X 1-3/4 X 0.25 WEB	41	16
15	PLATE	5/8 X 42	42	1
16	STIFFENER	3/8 X 80	15	2
17	STIFFENER	3/8 X 5-1/2	15	1
18	STIFFENER	3/8 X 5-1/4	5-1/4	4
19	STIFFENER	3/8 X 1-5/8	5-1/2	24
20	PAD	3/8 X 30	14-3/4	2
21	PAD	3/8 X 30	10-3/4	2
22	PAD	3/8 X 30	8-1/4	2
23	PAD	3/8 X 30	6	2
24	PAD	3/8 X 1-1/2	1-1/2	72

- ✓ MATERIAL FOR PIECE NUMBERS 1 THROUGH 14 SHALL BE IN ACCORDANCE WITH TYPE A, GRADE M OF MIL-S-20166
- ✓ MATERIAL FOR PIECE NUMBERS 15 THROUGH 24 SHALL BE IN ACCORDANCE WITH TYPE I, GRADE M OF MIL-S-16113

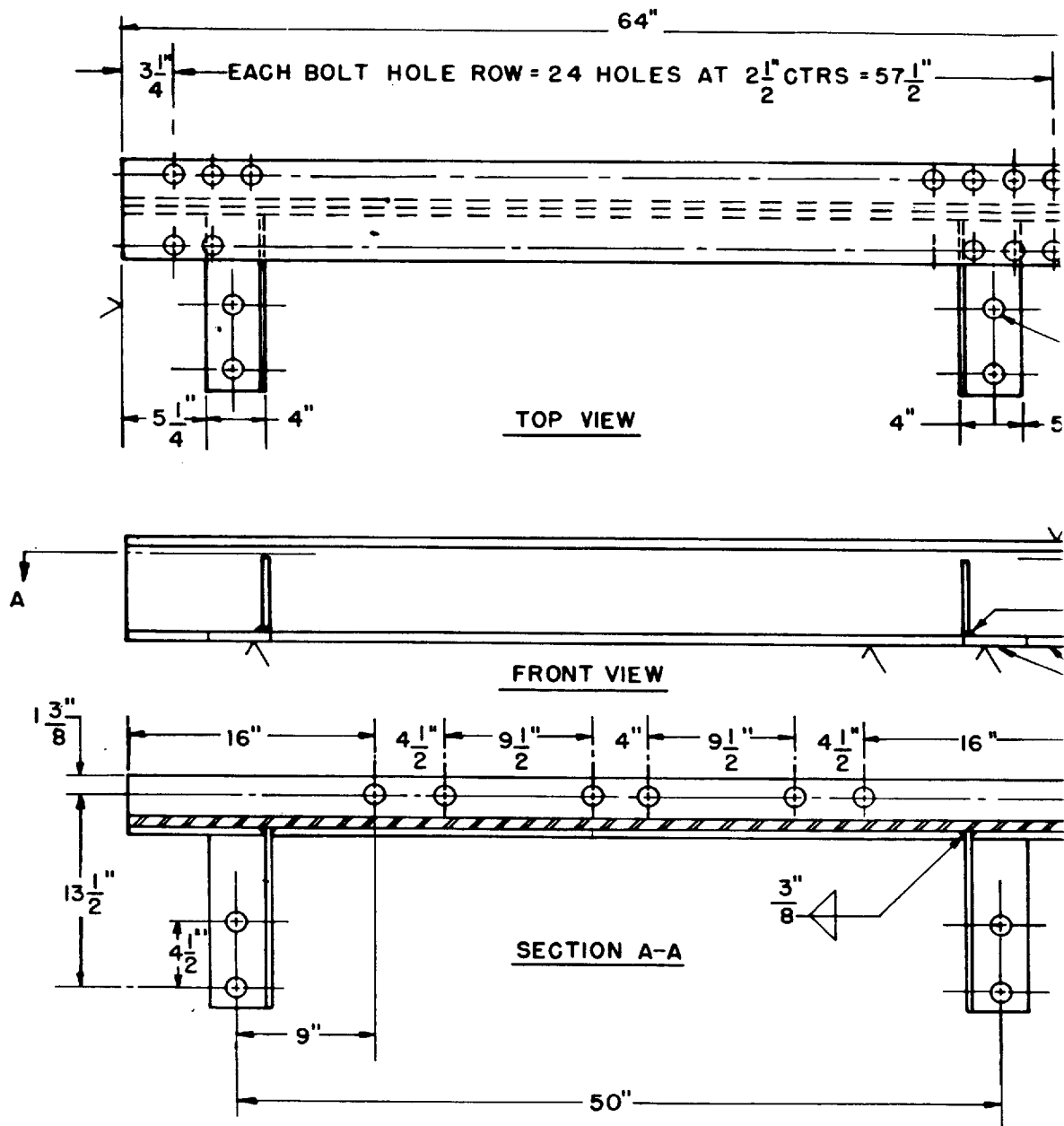
NOTES.

- UNLESS OTHERWISE SPECIFIED HEREIN OR IN THE INDIVIDUAL EQUIPMENT SPECIFICATION, SURFACE ROUGHNESS, AS ROLLED OR DRAWN, PUNCH CUT OR MACHINED SHALL HAVE A 250 FINISH AND SHALL BE IN ACCORDANCE WITH MIL-STD-10
- THREADS SHALL BE IN ACCORDANCE WITH H 28 AND MIL-STD-9
- UNLESS OTHERWISE SPECIFIED HEREIN OR IN THE INDIVIDUAL EQUIPMENT SPECIFICATION, ALL FILLET WELDS SHALL BE 1/4 INCH
- MACHINED SURFACES SHALL NOT BE PAINTED
- FABRICATION PROCEDURES AND INSPECTION STANDARDS FOR WELDING SHALL BE IN ACCORDANCE WITH CLASS I OF MIL-W-21157. WELD SHALL BE THE MANUAL SHIELDED ARC PROCESS USING WELDING ELECTRODE TYPE 7018 OF MIL-E-22200/1.
- STRESS RELIEF SHALL BE AT 1175 ± 25°F FOR A MINIMUM OF 3 HOURS, THEN THE FURNACE SHALL BE COOLED.
- WELDING SYMBOLS SHALL BE AS SPECIFIED IN MIL-STD-19.
- WELDING TERMS AND DEFINITIONS SHALL BE IN ACCORDANCE WITH MIL-STD-20.
- WELDED-JOINT DESIGNS SHALL BE AS SPECIFIED IN MIL-STD-22
- DIMENSIONS AND TOLERANCES SHALL BE AS SPECIFIED IN MIL-STD-8.
- THIS FIXTURE IS ATTACHED TO THE ANVIL PLATE OF THE MWSM BY MEANS OF SUPPORTS SHOWN ON FIGURE 11 AND CLAMPS SHOWN ON FIGURE 12.

1/2

30° MOUNTING FIXTURE FOR TESTING
BULKHEAD MOUNTED EQUIPMENT
ON MEDIUM WEIGHT SHOCK TESTING MACHINE

FIGURE 10-2

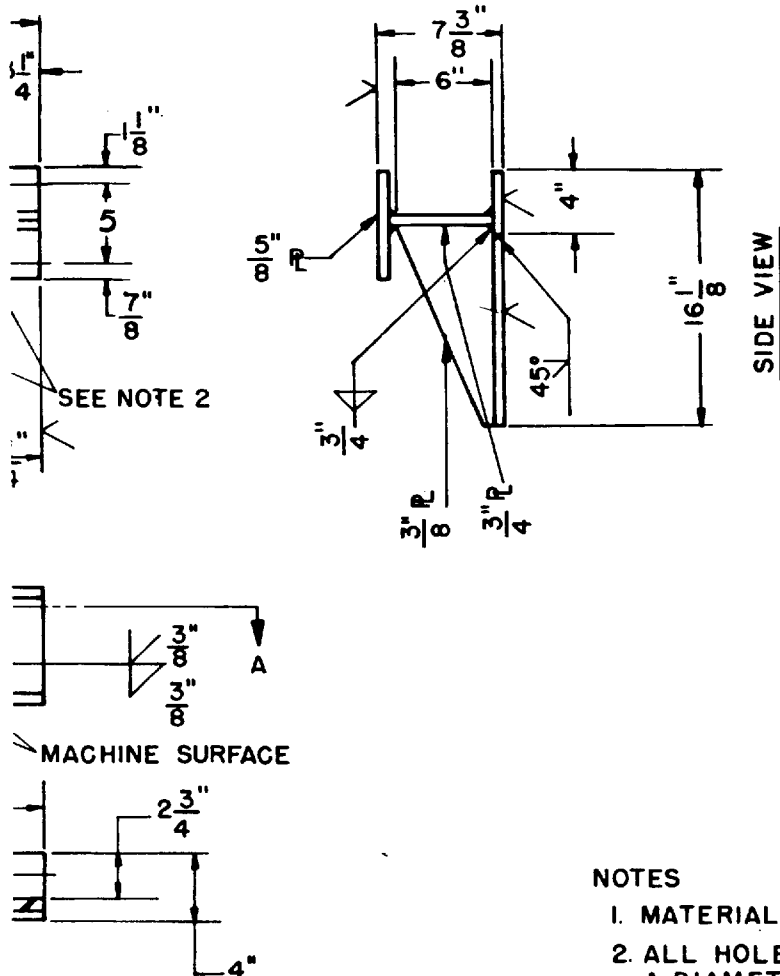


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SL

FOR 30° M
FOR TESTING BULKHEAD

MIL-C-901C(NAVY)



NOTES

1. MATERIAL SHALL BE STEEL.
2. ALL HOLES SHALL BE DRILLED TO A DIAMETER OF 1-1/16 INCH DIAMETER.
3. TWO SUPPORTS SHALL BE REQUIRED.
4. FINISH SHALL BE 125.
5. WHEN TESTING EQUIPMENT ON THE 30° MOUNTING FIXTURE (FIG. 10-2), THESE SUPPORTS ARE ATTACHED TO THE MWSM ANVIL PLATE IN PLACE OF THE SHIPBUILDING OR FABRICATED CHANNEL BASES SHOWN ON FIGURES 9-1 AND 9-2.
6. ATTACH THE 30° MOUNTING FIXTURE (FIG. 10-2) TO THESE SUPPORTS BY MEANS OF CLAMPS SHOWN ON FIGURE 12.

PPORTS

MOUNTING FIXTURE

MOUNTED EQUIPMENT (MWSM)

FIGURE 11



MIL-C-8010(NAVY)

FIGURE 12-4 TOP PLATE

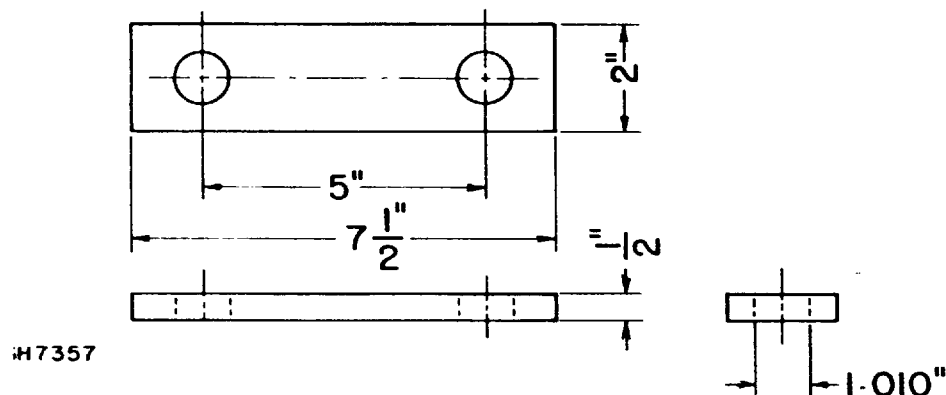
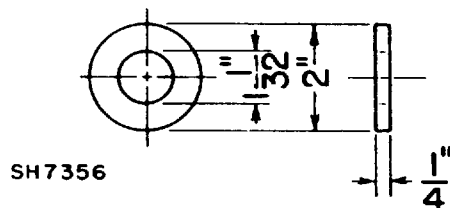


FIGURE 12-3 WASHER



NOTES:

1. MATERIAL SHALL BE 4340 STEEL
2. TOLERANCES SHALL BE PLUS OR MINUS 0.010 INCH
3. NUMBER OF CLAMPS, WASHERS, STUDS, BLOCKS, TOP PLATES, AND NUTS REQUIRED ARE AS FOLLOWS:
 - 4- CLAMPS
 - 8- WASHERS
 - 8- STUDS
 - 4- BLOCKS
 - 4- TOP PLATES
 - 8- 1 INCH-8NC ESNA NUTS

12 - CLAMPS

XTURE (FIG.10-2) & SUPPORTS

MIL-S-901B(NAVY)
 AMENDMENT - 3
16 September 1958
 SUPERSEDING
 Amendment - 2
 19 December 1955

MILITARY SPECIFICATION
 SHOCKPROOF EQUIPMENT, CLASS HI (HIGH-IMPACT),
 SHIPBOARD APPLICATION, TESTS FOR

This amendment forms a part of Military Specification MIL-S-901B(NAVY), 9 April 1954, and has been concurred in by all interested bureaus of the Department of the Navy.

Page 1, paragraph 1.2.1, line 3: Delete "4.4.1.2" and substitute "4.4.2".

Page 2, paragraph 2.1, under "MILITARY", insert the following:

"MIL-P-15024 - Plates, Identification— Information and Marking for Identification of **Electrical**, Electronic and Mechanical Equipment."

Page 3, paragraph 3.1.6: Delete and substitute:

"3.1.6 Equipment grades. - Equipment tested under this specification shall be grade I, II or III. Unless otherwise specified in the contract, purchase order or individual equipment specification (see 6.1), the equipment shall be grade I.

"3.1.6.1 Grade I. - Grade I equipment is defined as a design which will continue to perform its principal functions (see 6.1) throughout and after the application of shock of established magnitude by standard Navy shock testing machines, without the use of either external or internal resilient mountings.

"3.1.6.2 Grade II. - Grade II equipment is defined as a design which will continue to perform its principal functions (see 6.1) throughout and after the application of shock of established magnitude by standard Navy shock testing machines, with the use of resilient mountings which may be external, internal, or both.

"3.1.6.3 Grade III. - Grade III equipment is defined as a design which will continue to perform its principal functions (see 6.1) throughout and after the application of shock of established magnitude by standard Navy shock testing machines, both without the use of either external or internal resilient mountings, and also with the use of only external resilient mountings."

H

U-S-901B(NAVY)
 AMENDMENT - 3

Page 3, paragraph 3.3: Delete and substitute:

"2.3 Marking.- Equipment which passes these tests shall be designated as follows:

"3.3.1 Notes for drawing.-

"This equipment has been accepted as meeting the class HI shock requirements in accordance with Specification MIL-S-901, of _____ (date, by _____ (procuring activity or Government inspector) letter _____ (file No.), of _____ (date) under the following conditions:

- a. Type of mounting adapter used (i.e. 4A plate, 4C bracket, 30-degree mounting bracket, etc.) _____.
- b. Equipment grade (specify which and cover option in case of grade II).
 - (1) Grade I - without the use of either external or internal resilient mountings.
 - (2) Grade II - with the use of resilient mountings which were _____ (external, internal, or both).
 - (3) Grade III - without the use of either external or internal resilient mountings and also with the use of only external resilient mountings."

"3.3.2 Identification plates.-

"3.3.2.1 The Navy class HI shockproof designation may be placed upon the identification plate of the equipment only after specific bureau or agency acceptance: this acceptance may be based on the results of Inspector-witnessed factory tests.

"3.3.2.2 In the absence of post-shock test examination and corrective measures specified in the applicable purchase or equipment specification, articles which are to be shock-tested and retained by the Government shall be provided with identification plates having the same information as those in the lot from which the test samples are taken. In addition, the test samples shall be provided prior to the test with distinctive identification plates, adjacent to the regular identification plates, which shall have the following wording in light letters on a red background:

"CAUTION

Substandard Unit

Unit has been class HI shock tested and possibly damaged. To be used only at specific direction of bureau or agency concerned _____."

"3.3.3 Parent equipment.- For type II when using external mounts and type III, the Government stock number of the intended mount shall be indicated at a location adjacent to each mount. The marking may be accomplished by a separate plate conforming to Specification MIL-P-15024. This marking shall read as follows: "Mount No. _____ (Government Stock No.) only is to be used to this location.""

Page 6, paragraph 4.4.5.2: Delete and substitute:

"4.4.5.2 When a test sample has satisfactorily passed the shock test and is to be retained by the Government, the manufacturer shall thoroughly inspect the sample and correct all minor damage which may have occurred during the test. In addition, post-shock test examination and corrective measures as specified in the applicable purchase or equipment specification shall be performed. The tested sample shall then be delivered to the Government inspector for disposition as directed by the bureau or agency concerned."

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AMENDMENT - 3

Page 6, paragraph 4.5: Delete and substitute:

· 4.5 Test records. -

“4.5.1 Tests at a commercial facility. -

“4.5.1.1 Form. - The results of shock tests shall be recorded on form NAVEXOS 3373. A copy of the completed form shall be submitted by the testing facility to the Government inspector.

“4.5.1.2 Acceptance. - If the equipment passes the class HI shock test satisfactorily, including the post-shock test examination, as determined by the Government inspector, he may accept the equipment as far as shock is concerned or refer action to the procuring activity. A copy of the Government Inspector's action, along with a copy of the test report, will be forwarded to the procuring activity.

“4.5.1.3 Rejection. - If the equipment fails to pass the class HI shock test satisfactorily, including the post-shock test examination, as determined by the Government inspector, the Inspector shall so advise the manufacturer. The manufacturer shall then inform the procuring activity via the Government Inspector as to the proposed design changes which will correct the deficiencies. In certain cases the procuring activity may decide to accept the equipment as HI shockproof on the basis of the corrective design changes instead of requiring retest.

“4.5.2 Inspection tests at a Government laboratory. -

“4.5.2.1 Form. - The results of the class HI shock tests shall be reported in accordance with Chapter 4 of Publication NAVSHIPS 250-350.

“4.5.2.2 Acceptance. - The requirements of 4.5.1.2 shall apply.

“4.5.2.3 Rejection. - The requirements of 4.5.1.3 shall apply.

“4.5.3 Qualification tests at a Government laboratory. -

“4.5.3.1 Form. - The requirements of 4.5.2.1 shall apply.

“4.5.3.2 Acceptance and rejection. - The procedure for acceptance and rejection shall be specified by the bureau or agency concerned.”

Page 7, paragraph 6.1: Add:

“(k) Equipment grade (see 3.1.6).”

Page 7, paragraph 6.3: Delete.

Page 8, last line: Delete “S”.

Custodian:
Navy - Bureau of Ships

Preparing activity:
Navy - Bureau of Ships
(Project X999-0012Sh)

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of 3 pages

MIL-S-901B(NAVY)

9 APRIL 1954

SUPERSEDING

MIL-S-901A

5 JANUARY 1952

NAVY.EDU.

Santa Barbara

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MILITARY SPECIFICATION

SHOCKPROOF EQUIPMENT, CLASS HI (HIGH-IMPACT) , SHIPBOARD APPLICATION, TESTS FOR

All interested Bureaus of the Navy Department have concurred in the use of this specification.

1. SCOPE

1.1 Scope. - This specification covers the methods to be followed in conducting required high-impact shock tests on equipment for use on Naval vessels. These tests will be conducted for the purpose of determining the suitability of the equipment as regards the effects of severe shock liable to be incurred in wartime service.

1.2 Classification. - Tests for class HI shockproof equipment shall be of the following types as specified in the contract or order, or equipment specification (see 6.1):

Type A - For completely assembled apparatus (see 3.1.1).

Type B - For subassemblies (see 3.1.2).

Type C - For individual devices (see 3.1.3).

1.2.1 Weights. - The equipment shall be classified for the purpose of test as follows (see 6.1):

Light - Approximately 250 pounds and below (see 4.4.1.2).

Medium - Approximately 250 pounds to approximately 4,500 pounds (see 4.4.1.2).

Heavy - Above approximately 4,500 pounds.

H

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2. APPLICABLE DOCUMENTS

2.1 The following specifications and drawings, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

MILITARY

MIL-B-857 - Bolts, Nuts, Studs, and Tap Rivets (and Material for Same).
MIL-P-15035 - Plastic-Material, Laminated, Thermosetting: Sheets,
Cotton-Fabric-Base, Phenolic-Resin.

NAVY DEPARTMENT

General Specifications for Inspection of Material.

DRAWINGS

BUREAU OF SHIPS

10-T-2145-L - Shock-Testing Machine.
NO807-655947 - HI Shock-Testing Machine, Medium-Weight, Outline
Thirty Sheets.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Definitions.-

3.1.1 Type A.- The type A test is the preferred type of test and should be specified whenever a testing machine of sufficient capacity to handle the completely assembled apparatus is available.

3.1.2 Type B.- The type B test should be specified only in those cases when a testing machine of sufficient capacity to handle the completely assembled apparatus is not available. The type B test is applicable to subassemblies of a complete device; for example, the rotor of a motor or generator, the throttle trip valve and associated overspeed trip mechanism of a turbine, the lamp of a searchlight, or a single cubicle of a switchboard unit containing several draw-out circuit-breakers. Inasmuch as the type B test applies to subassemblies having specific applications, the approval under this test will be limited to the specific application.

3.1.3 Type C.- The type C test has wide application to the testing of numerous individual devices having a variety of shipboard applications. The type C test is intended to apply to individual devices such as instruments, circuit-breakers, controller components, motors, resistors, rheostats, relays, meters, turbines, and other devices that may be employed in a variety of applications with the result that the method of mounting in service may vary widely, depending upon the application. A device approved under the type C test may be applied in an accepted manner aboard ship, subject to any limitations specified in the approval letter. An apparatus which is composed entirely of components which have satisfactorily passed the type C test may not require either the type A or B test, subject to approval of the assembly and mounting details of the components and supporting structure by the Government inspector and the bureau or agency concerned.

3.1.4 Medium-weight.- The 4,500-pound limit for the medium-weight classification is based on a weight of mounting platform of 1,100 pounds for the medium-weight shock-testing machine. Equipment of greater weight should be classified as medium-weight equipment, when the total weight of equipment plus mounting does not exceed 5,600 pounds.

3.1.5 Heavy-weight.- Equipment in the "heavy" classification will be given the type A test when Navy standard testing machines are available for this purpose.

3.1.6 Shockproof equipment. - Shockproof equipment is defined as a design which will continue to perform its principal functions (see 6.1) throughout and after the application of shock of established magnitude by standard Navy shock testing machines. Equipment whose satisfactory performance under shock is dependent upon shockmountings which are either an integral or nonintegral part of the equipment shall not be considered as shockproof. This restriction applies primarily to shockmounts which require maintenance and are subject to deterioration.

3.2 Basis of acceptability. - Acceptability will be contingent upon the equipment withstanding the shock resulting from the test specified in 4.4. During or subsequent to the test the apparatus shall not fail to perform its principal functions. Failure to perform its principal functions is defined as failure of the tested apparatus to function satisfactorily as specifically defined for the particular apparatus in the specification covering the equipment, the contract, or order, as applicable. None of the parts or objects shall become detached from the apparatus. Equipment mounting bolts shall not fail nor show appreciable loosening due to stretching. Minor chipping of parts such as plastic knobs and cases and minor distortion of parts will be permitted where such chipping or distortion cannot in any manner impair the operation of any parts. The apparatus shall not require any attention or adjustment or replacement of parts to enable it to perform its principal functions during and after each blow of the test.

3.3 Marking. - Equipment which passes these tests shall be designated as follows:

Notes for drawings. -

This equipment has been accepted as Navy class HI shockproof equipment (Spec. MIL-S-901) by (bureau or agency) letter _____.

This equipment has been successfully tested for Navy class HI shock (Spec. MIL-S-901), at the place of manufacture, as reported by Inspector of Material letter _____. Bureau or agency acceptance not yet granted.

Identification plates. -

The Navy class HI shockproof designation may be placed upon the identification plate of the equipment only after specific bureau or agency acceptance; this acceptance may be based on the results of inspector-witnessed factory tests.

Articles which are to be shock-tested and retained by the Government shall be provided with identification plates having the same information as those in the lot from which the test samples are taken. In addition, the test samples shall be provided prior to the test with distinctive identification plates, adjacent to the regular identification plates, which shall have the following wording in light letters on a red background:

CAUTION

Substandard Unit

Unit has been class HI shock tested and possibly damaged. To be used only at specific direction of bureau or agency concerned _____.

3.4 Workmanship. - The workmanship shall be such as to insure satisfactory operation under conditions of class HI mechanical shock as specified herein.

4. QUALITY ASSURANCE PROVISIONS

4.1 Standard Navy shock-testing machines. - The shock-testing machine for light-weight equipment shall be constructed in accordance with Drawing 10-T-2145-L as shown on figure 1. The shock-testing machine for medium weight equipment, shown on figure 2, shall be constructed in accordance with Drawing NO807-655947. For heavy equipment the shock-testing machine shall conform to the requirements to be developed for this machine.

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4.2 Types of assemblies. -

4.2.1 Completely assembled apparatus (type A). - The completely assembled apparatus to be tested shall be mounted on the shock machine in a manner simulating the most severe (as regards shock) method that will be used aboard ship. (See 4.3.) This mounting is generally specified in the specification covering the equipment. The mounting feet, bolt holes, or other means provided for securing the apparatus when installed on shipboard, shall be used in mounting the apparatus for the shock test.

4.2.2 Subassemblies (type B). - The subassemblies shall be mounted in a manner which is approved as being dynamically equivalent to the mounting provided when they are assembled to form the complete apparatus. (See 3.1.2.)

4.2.3 Individual devices (type C). - Individual devices shall be subjected to shock tests only if they will have general applications. Such devices shall be mounted on the test machine, using the normal mounting provisions of the device. (See 3.1.3.)

4.3 Methods of mounting. -

4.3.1 Light-weight equipment. - The shock machine for light-weight equipment is provided with the anvil plate shown on figure 3. Unless otherwise specified in the contract or order, or the equipment specification, the apparatus to be tested shall be mounted by means of standard mountings, the plans for which are shown on figures 4A, 4C, 6D (sheets 1 and 2), and 6E.

4.3.1.1 An item of equipment that has passed the shock test when mounted on figure 4A or 4C mounting, as appropriate, need not be retested for applications where the figure 6E mounting would ordinarily be required. For example, a switch that has passed tests on the figure 4A or 4C mounting need not be retested on the 6E mounting if it is to be utilized as a controller component. When an item of equipment has passed shock tests mounted on the figure 6D or 6E mounting, it shall be limited to applications for which these mountings are appropriate. Where a specific test mounting is designated in the particular equipment specification, that mounting shall be utilized in all instances unless exception is made by the bureau or agency concerned.

4.3.1.2 When the equipment has been mounted for a test upon a standard mounting, its position upon the standard mounting shall not be changed during the course of the test.

4.3.1.3 There shall be no variation in the construction of these standard mountings without specific approval of the bureau or agency concerned. In the event that none of the standard mountings can be utilized for a particular piece of equipment, or if there is some doubt as to which mounting is applicable, the bureau or agency concerned shall be consulted to determine an appropriate mounting. It is the intent of these standard mountings to approximate the actual rigidity encountered aboard ship in the utilization of the particular equipment.

4.3.1.4 Mounting bolts for fastening the equipment shall conform to type A or B, class B of Specification MIL-B-857.

4.3.2 Medium-weight equipment. - The shock machine for testing medium-weight equipment is shown on figure 2. The equipment shall be attached to the anvil table of the machine by means of a standard mounting platform specified herein, or a mounting adaptor satisfactory to the bureau or agency concerned. In general, the adaptor should provide a stiffness approximately equivalent to the most rigid mounting on which the equipment would normally be placed aboard ship. In no case shall the equipment be mounted directly to the anvil table. The standard mounting platform shown on figure 7A is approved for use where applicable; however, mounting adaptors differing from figure 7A shall be used where specified in the equipment specification, contract or order. Mounting bolts for fastening the equipment shall conform to type A or B, class B of Specification MIL-B-857.

4.3.3 Heavy equipment. - For heavy equipment, the method of mounting shall conform to the requirements to be developed for such method.

4.4 Test procedure. - The apparatus or equipment shall be tested in each of its principal operating conditions subject to shock in service; for example, motors shall be tested running at rated speed and at standstill, and contactors shall be tested in the open and closed position. Unless otherwise specified in the contract or order or the equipment specification, the procedure shall be as follows:

4.4.1 For light-weight equipment. -

4.4.1.1 A total of nine blows shall be applied, employing the machine shown on figure 1. Three blows shall be applied parallel to each of three principal axes of the apparatus being tested, the three blows for each direction to be with heights of hammer drop of 1 foot, 3 feet, and 5 feet. For light-weight equipment having two or more electrical or mechanical operating conditions (for example, circuit-breakers and switches), the nine blows shall be delivered for each condition; separate items of equipment may be submitted for each series of nine blows if desired by the manufacturers.

4.4.1.2 Equipment within the range of 250 to 400 pounds may be tested on the light-weight machine if specified by the bureau or agency concerned (see 6.1). Requests for class HI shock tests on equipment in this weight range shall indicate whether tests are desired on the light or medium-weight machine. A note shall also be incorporated on the applicable plan indicating the shock machine utilized.

4.4.2 For medium-weight equipment. - The tests shall be made on the medium-weight shock machine shown on figure 2, and a total of six blows shall be applied to the equipment. The six blows shall consist of three groups of two blows each. For each group, the height of hammer drop and the initial up travel of the anvil table shall be as shown in table I.

4.4.3 For heavy-weight equipment. - Procedure will be established when the testing machine becomes available.

4.4.4 General. -

4.4.4.1 Unless otherwise approved by the bureau or agency concerned, electrical circuits at rated voltage values (and rated current, when practicable) for the equipment under test shall be established during the test and records made by suitable means of both "make" and "break" in the circuit which can be attributed to shock.

Table I - Height of hammer drop, feet.

Group number-----	I	II	III
Number of blows-----	2	2	2
Anvil table travel, inches---	3	3	1-1/2
Total weight on anvil table, pounds:			
250 - 1,000	0.75	1.75	1.75
1,000 - 2,000	1.0	2.0	2.0
2,000 - 3,000	1.25	2.25	2.25
3,000 - 3,500	1.5	2.5	2.5
3,500 - 4,000	1.75	2.75	2.75
4,000 - 4,200	2.0	3.0	3.0
4,200 - 4,400	2.0	3.25	3.25
4,400 - 4,600	2.0	3.5	3.5
4,600 - 4,800	2.25	3.75	3.75
4,800 - 5,000	2.25	4.0	4.0
5,000 - 5,200	2.5	4.5	4.5
5,200 - 5,400	2.5	5.0	5.0
5,400 - 5,600	2.5	5.5	5.5

Note 1. - Total weight on anvil table is the sum of equipment weight plus weight of mounting.

Note 2. - The height of hammer drop shall be measured by means of the existing markings on the scale of the machine, no corrections being made for the added anvil table travel for the blows of groups I and II.

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4.4.4.2 Cable, bus, pipe, or shaft connections to the apparatus under test shall be sufficiently flexible to prevent attenuation of the shock imparted to the apparatus by the test machine.

4.4.4.3 All mounting bolts of the apparatus and shock-machine mounting shall be tightened before each test blow is delivered.

4.4.4.4 The motion of the equipment under test shall be recorded for each blow in each direction, when and as specified by the bureau or agency concerned.

4.4.4.5 The overall dimensions, the weight, and the approximate location of the center of gravity of the equipment, together with a sketch of the method of mounting on the shock-testing machine, shall be recorded.

4.4.4.6 The test report shall include detailed descriptions of any damage incurred after each blow, and, where practicable, photographs showing the damage incurred should supplement this description. Also copies of the records obtained under 4.4.4.1, 4.4.4.4, and 4.4.4.5 shall be included in the report.

4.4.4.7 After completion of the shock test the apparatus or equipment shall be given suitable tests to determine whether or not it performs its principal functions as specified in 3.2. When applicable, the equipment or apparatus shall be subjected to a dielectric test consisting of a 1-minute application of an alternating-current voltage having a value of 65 percent of the dielectric test voltage specified in the equipment specification or the contract or order. No insulation breakdown shall occur. For equipment on which hydraulic pressure tests are required to determine conformance with 3.2, such tests shall be made at the pressure specified for routine tests in the equipment specification.

4.4.5 Disposition of shock-tested equipment. -

4.4.5.1 Because of possible damage sustained during the shock test, articles subjected to the high-impact shock test will not be acceptable either as a whole or as a part assembled with other nontested articles to form a unit of equipment, and shall be discarded unless retained by the Government under the terms of the contract or order as specifically authorized by the bureau or agency concerned.

4.4.5.2 When a test sample has satisfactorily passed the shock test and is to be retained by the Government, the manufacturer shall thoroughly inspect the sample, correct all minor damage which may have occurred during the test, and then deliver the tested sample to the Government inspector for disposition as directed by the bureau or agency concerned.

4.5 Test records. - Shock tests performed at the manufacturer's plant shall be recorded on form NAVEXOS-3373 (see 6.4).

4.6 Inspection procedures. - For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

5. PREPARATION FOR DELIVERY

5.1 There are no packaging, packing, and marking requirements applicable to this specification.

6. NOTES

6.1 Ordering data. - Procurement documents should specify the following, when the equipment is required to be Navy class HI shockproof:

- (a) Title, number, and date of this specification.
- (b) The required type of shock test. (See 1.2.)
- (c) The weight designation of the shock test and the shock machine to be employed if the equipment weight range is 250 to 400 pounds (see 1.2.1 and 4.4.1.2).
- (d) Principal functions of the equipment or apparatus. (See 3.1.6.)
- (e) A definition of "failure to perform principal functions." (See 3.2.) Permissible minor adjustments which may be made either during or at the conclusion of the shock test.

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- (f) Description or designation of acceptable method of mounting the equipment on the shock-testing machine for test. (See 4.3.)
- (g) Exceptions to this specification, if any.
- (h) The place at which the shock test will be conducted, that is, at a Government laboratory designated by the bureau or agency concerned or at the place of manufacture, or at both.
- (i) The number of individual articles from each manufacturing lot to be tested.
- (j) Disposition of shock tested samples. (See 4.4.5.)

6.2 General information. -

6.2.1 The following information is listed herein for the assistance of the designer and, in those cases where equipment cannot be shock tested, for the assistance of the Government agency approving drawings prior to manufacture:

- (a) The deflection of semi-rigid parts under shock is quite large and accordingly there should be ample clearances to prevent electrical short circuits and impact damage.
- (b) Desirable material properties are strength, ductility, and, in some cases, low density. Undesirable properties are brittleness, low impact resistance, and high notch sensitivity.
- (c) In the application of material, ample cross sections should be provided and factors causing stress concentration such as sharp corners and sudden changes in cross section should be avoided.
- (d) In the design of mechanisms (for example, voltage regulators and relays) well constructed elastic hinges or shafts and bearings are preferred to knife-edge pivots.
- (e) Riveted joints, or screws and bolts with heads formed by extreme cold-working should not be used. When bolted joints are employed, the bolts should have a minimum clearance in the holes; or dowels should be used. Welded and brazed joints are the most satisfactory.
- (f) Levers, linkages and other moving parts of mechanisms should be balanced (either individually or in groups), whenever practicable, in order to reduce the tendency to maloperation under shock.

6.2.2 This specification is very general, so as to cover the entire field of shipboard equipment and apparatus, except certain electronic and navigational equipment for which other specifications are applicable. In order to apply this specification properly, it is necessary to specify separately, describe, or define the features enumerated in 6.1.

6.2.3 Equipment approved on the basis of the previous edition of this specification will retain approval until such time as tests on the basis of this edition proved the equipment to be unsatisfactory.

6.3 Enlarged copies of figures 4A, 4C, 6D, 6E, and 7A will be supplied by the Bureau of Ships upon request.

6.4 Test record. - The applicable test record form is NAVEXOS-3373, Factory Test Record, Class HI Shock. Pads of these forms may be obtained upon application to the Government inspector, except that activities of the Armed Forces should make application to the Commanding Officer, Naval Supply Depot, Scotia 2, N.Y. When requesting pads, refer to both the title and number. (See 4.5.)

6.5 Superseding documents. - The superseded Navy Specification number is 66S3.

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Patent notice. - When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:

Navy - Bureau of Ships

Other interest:

Navy - OrS

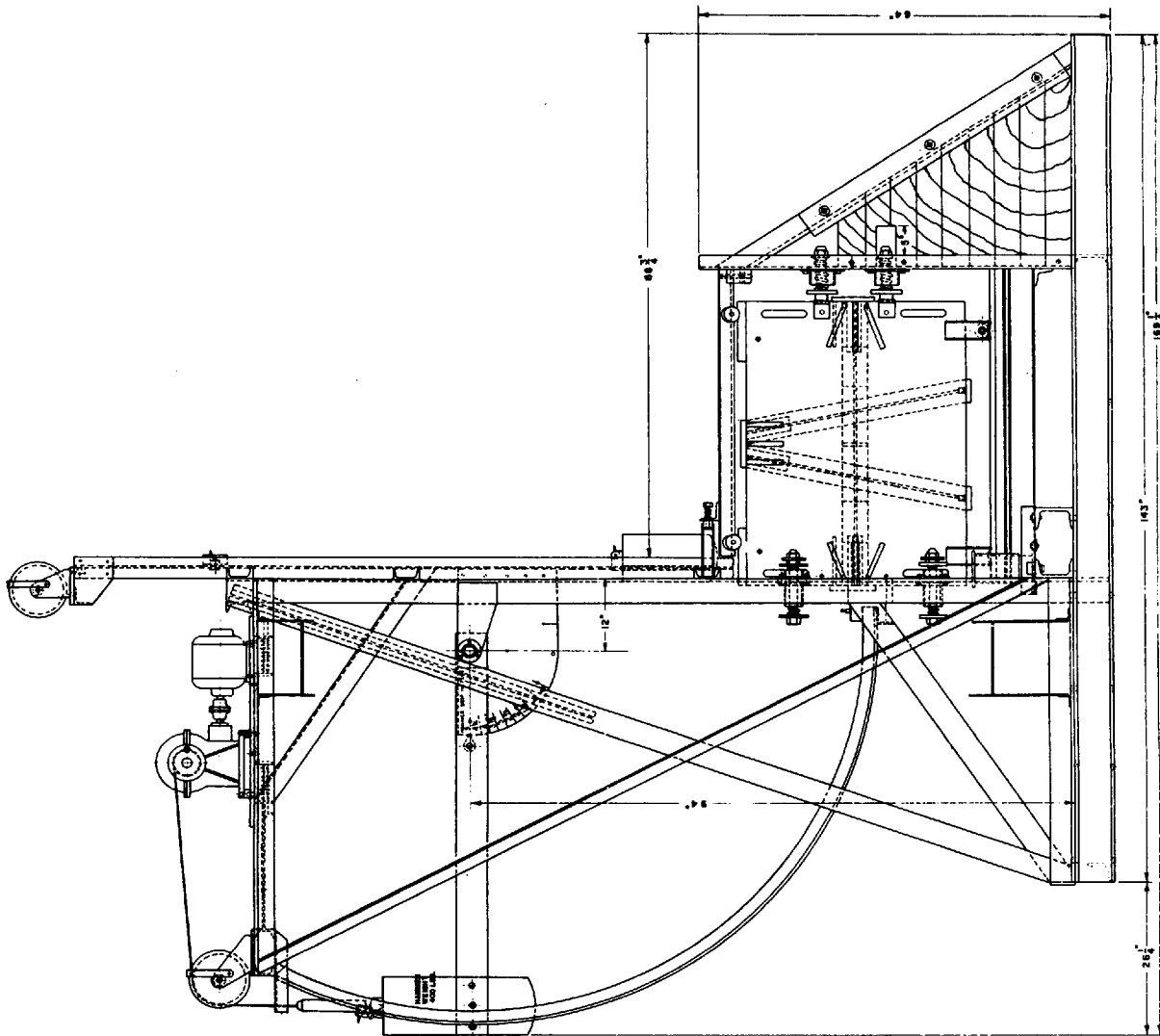
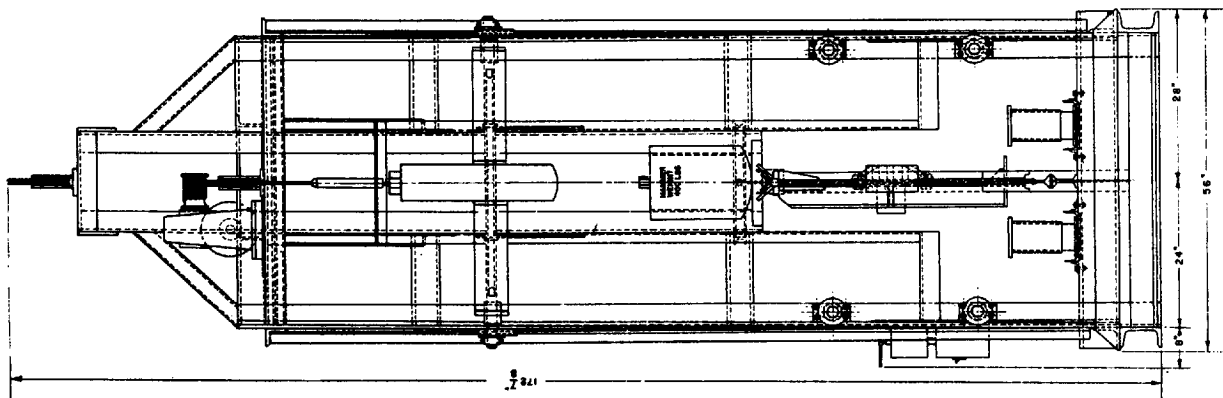


FIG. 1
SHOCK TESTING MACHINE FOR LIGHT WEIGHT EQUIPMENT



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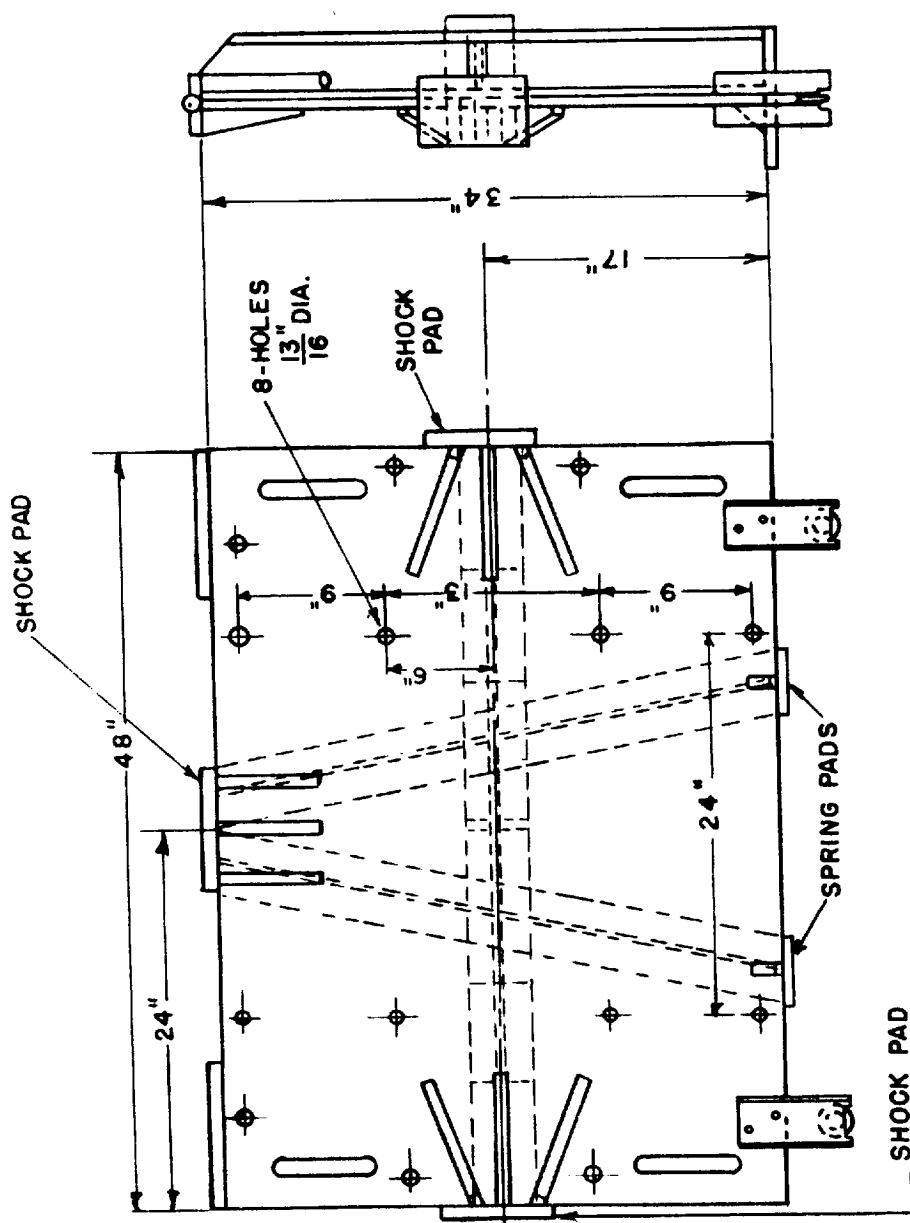
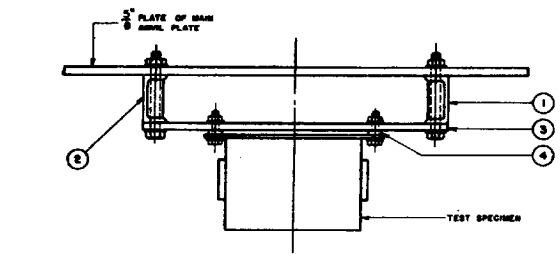


Figure 3.-Anvil plate of shock-testing machine for lightweight equipment.



LIST OF MATERIAL					
QUANTITIES ARE FOR: ONE MOUNTING					
PRICE NUMBER	NAME OF ITEM	QTY.	MATERIAL	MATERIAL SPECIFICATION	FINISH
1	CAR BUILDING CHANNEL - 4" X 13.5	1	STEEL		
2	CAR BUILDING CHANNEL - 4" X 13.5	1	STEEL		
3	AUXILIARY MOUNTING PLATE	1	STEEL		
4	SPACER (SEE TABLE 1 FOR SIZE)	4/DOZ	STEEL		
5	5/16 X 1" LB. HEX. HD. BOLT	8	STEEL		
6	5/16 HEX. HD. NUT	8	STEEL		
7	WASHER - 5" O.D. X 1/4" LB.	16	STEEL		
8	1" STD. PIPE SPACER - 8" LB.	8	STEEL		

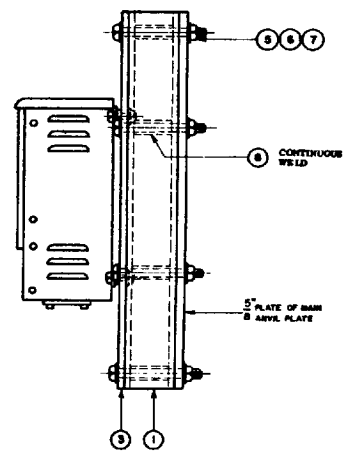
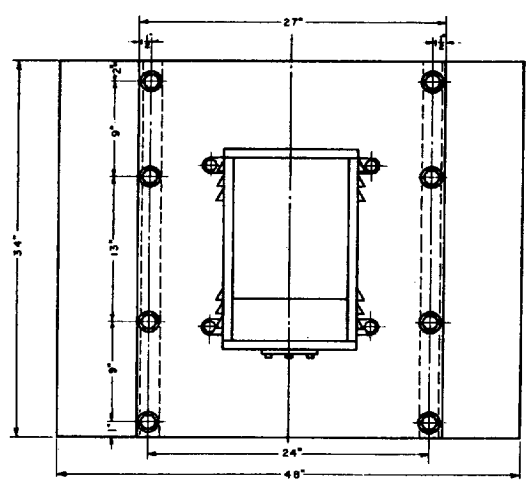
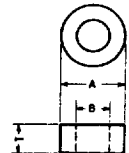


TABLE 1

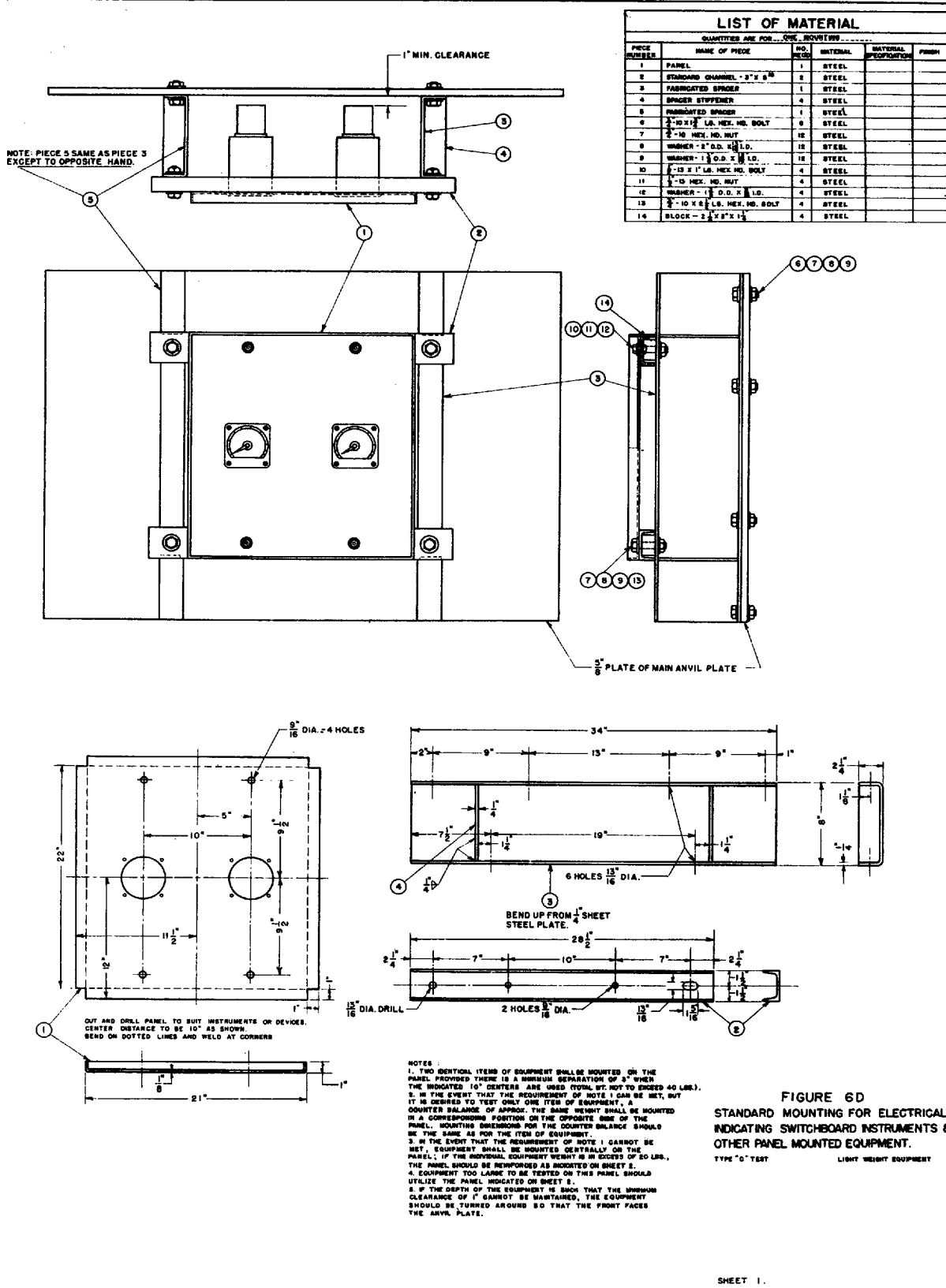
BOLT SIZE	SPACER DIMENSIONS			
	A	B	C	T
1/4"	1/4"	1/4"	1/4"	1/4"
5/16"	1/4"	1/4"	1/4"	1/4"
3/8"	1/4"	1/4"	1/4"	1/4"
1/2"	1/4"	1/4"	1/4"	1/4"
5/8"	1/4"	1/4"	1/4"	1/4"
3/4"	1/4"	1/4"	1/4"	1/4"

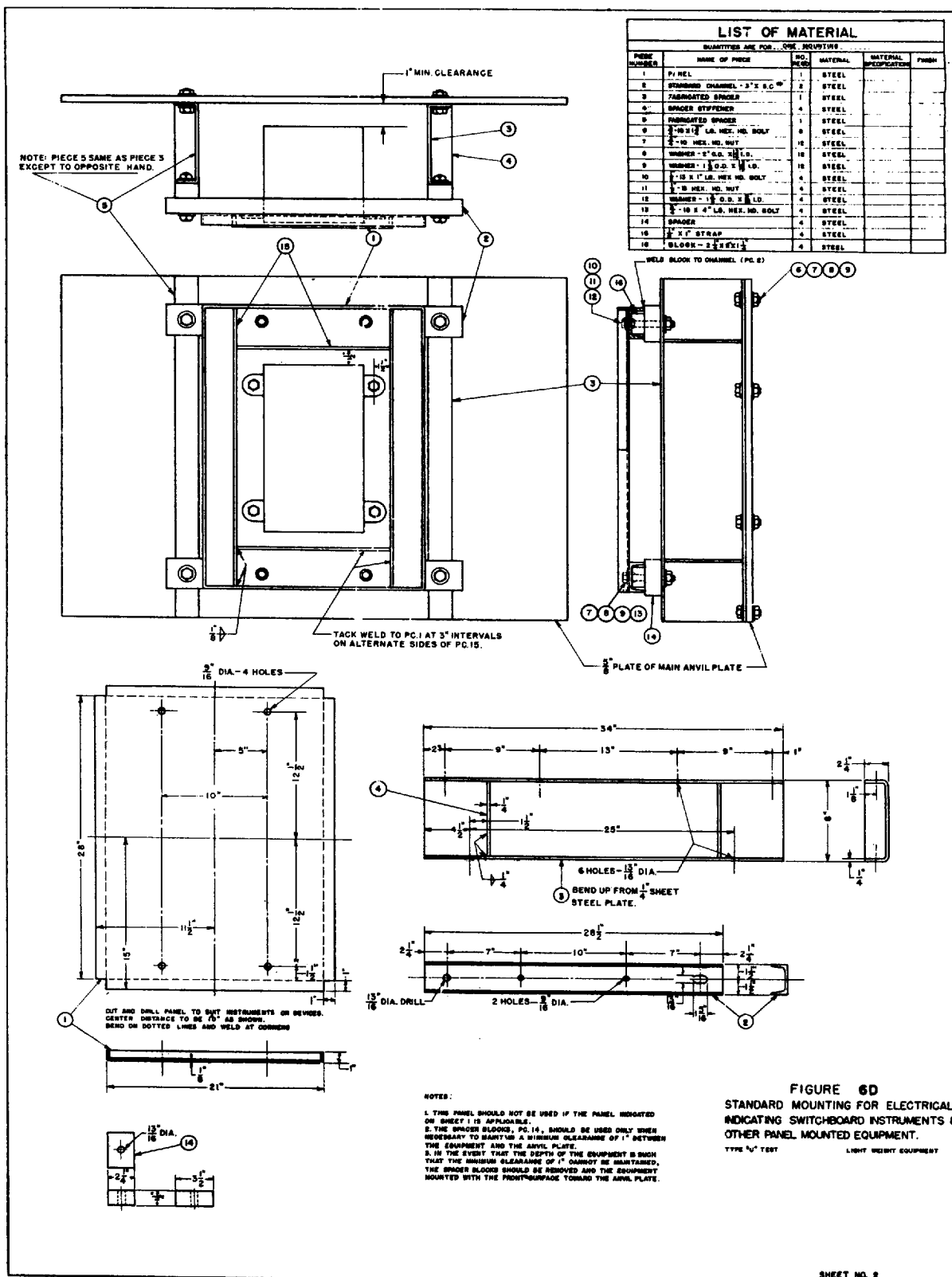
SPACERS TO BE USED WHEN SECURING EQUIPMENT TO THE AUXILIARY MOUNTING PANEL.



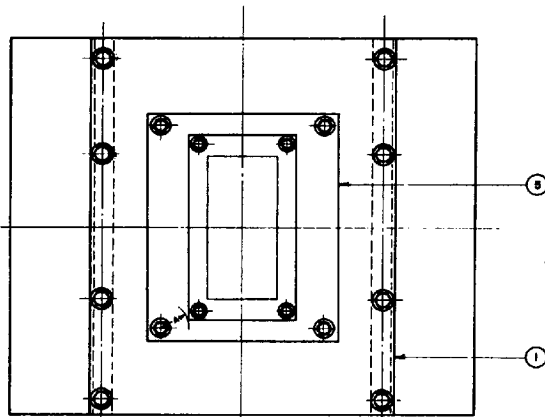
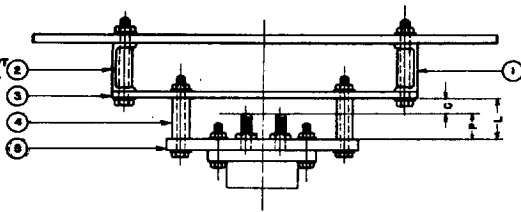
NOTES -
1. THE SIZE OF THE AUXILIARY MOUNTING PLATE, PG. 3, MAY BE INCREASED IN WIDTH ONLY, FROM 27" TO A MAXIMUM OF 36" AS REQUIRED FOR LARGE ITEMS OF EQUIPMENT.
2. ONE SPACER OF THE SIZE INDICATED IN TABLE 1 SHALL BE UTILIZED FOR EACH EQUIPMENT MOUNTING BOLT.

FIGURE 4A
STANDARD MOUNTING FOR
BULKHEAD MOUNTED EQUIPMENT
TYPE "A" TEST - LIGHT WEIGHT EQUIPMENT

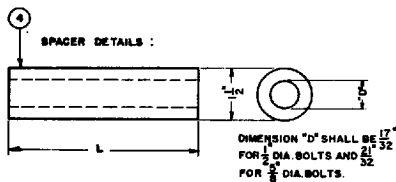




SAME AS PC1 EXCEPT
TO OPPOSITE HAND.



DIMENSION "A", AS MEASURED FROM THE CENTER OF ANY MOUNTING HOLE
OF PC5 TO THE COMPONENT MOUNTING BASE, SHALL NOT BE LESS THAN $2\frac{1}{2}$ ".



DIMENSION "D" SHALL BE $\frac{17}{32}$ "
FOR $\frac{1}{2}$ " DIA. BOLTS AND $\frac{21}{32}$ "
FOR $\frac{3}{8}$ " DIA. BOLTS.

TABLE 1

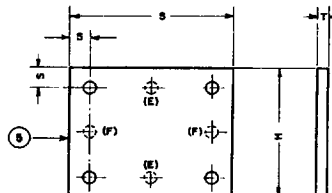
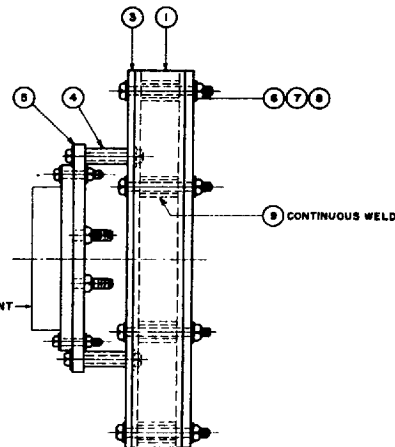
WHEN P (NOTE ASSEMBLY PLAN VIEW) IS:		L	NOTES:
LESS THAN	GREATER THAN		
$\frac{1}{2}$ "	—	$\frac{1}{4}$ "	
$\frac{3}{8}$ "	$\frac{1}{2}$ "	$P + \frac{1}{8}$ "	
—	$\geq \frac{1}{2}$ "	4	OUT OUT $\frac{1}{8}$ " THICK AUXILIARY MOUNTING PLATE, PC 5, TO GIVE $\frac{1}{8}$ " CLEARANCE AROUND REAR PROJECTIONS.

NOTES:
L THE MANUFACTURER IS TO PROVIDE THE APPROPRIATE PLATING
AND FINISH IN TABLE 1, CONFORMING WITH ALL APPLICABLE
LABORATORY FOR TEST.

LIST OF MATERIAL

QUANTITIES ARE FOR ONE MOUNTING					
PIECE NUMBER	NAME OF PIECE	NO. REQ'D	MATERIAL	MATERIAL SPECIFICATION	FINISH
1	CAR BUILDING CHANNEL - 4" x 13.8"	1	STEEL		
2	CAR BUILDING CHANNEL - 4" x 13.8"	1	STEEL		
3	$\frac{1}{2}$ x 27" x 54" AUXILIARY PLATE	1	STEEL		
4	SPACER (NOTE TABLE 1)	—	STEEL		
5	TYPE 'C' LIGHT WEIGHT EQUIPMENT	—	TYPE 'C' LIGHT WEIGHT EQUIPMENT		
6	$\frac{3}{8}$ - 10 x 7" L.G. HEX. HD. BOLT	8	STEEL		
7	$\frac{3}{8}$ - 10 HEX. HD. NUT	8	STEEL		
8	WASHER - 2" O.D. x $\frac{13}{16}$ " ID	16	STEEL		
9	1" STD. PIPE SPACER - 2 $\frac{1}{16}$ "	8	STEEL		

* THE SIZE OF THE AUXILIARY PLATE SHOULD BE INCREASED TO
 $\frac{1}{2}$ x 36" x 34" FOR PANELS NO. 5 AND NO. 6 LISTED IN TABLE 2.



HOLES (E) ARE DRILLED EQUIDISTANT FROM CORNER HOLES ON SAME CENTER
LINE - PANEL NO. 5 AND 6 ONLY. HOLES (F) ARE DRILLED EQUIDISTANT FROM
CORNER HOLES ON SAME CENTER LINE - PANEL NO. 4 AND 6 ONLY.

TABLE 2

PANEL NO.	B	H	T	S	NO. AND SIZE OF BOLTS	DIA. BOLT HOLES
1	9"	18"	$\frac{1}{2}$ "	1"	4 - $\frac{1}{2}$ x 12	$\frac{1}{2}$ "
2	18"	18"	1"	1"	4 - $\frac{1}{2}$ x 12	$\frac{1}{2}$ "
3	18"	30"	1"	1"	4 - $\frac{1}{2}$ x 12	$\frac{1}{2}$ "
4	30"	24"	1"	1"	8 - $\frac{1}{2}$ x 12	$\frac{1}{2}$ "
5	36"	36"	1"	$\frac{1}{2}$ "	8 - $\frac{3}{8}$ x 11	$\frac{1}{4}$ "
6	36"	34"	1"	$\frac{1}{2}$ "	8 - $\frac{3}{8}$ x 11	$\frac{1}{4}$ "

SELECTION OF PANEL SIZE: THE PANEL EMPLOYED SHALL BE THE SMALLEST SIZE
SHOWN IN THE ABOVE TABLE THAT WILL RESULT IN A CLEARANCE, "A", (NOTE
ASSEMBLY FRONT ELEVATION VIEW) OF AT LEAST $\frac{1}{2}$ ".

FIGURE 6E

STANDARD MOUNTING FOR
ELECTRICAL CONTROLLER
COMPONENTS (CONTACTORS,
RELAYS, RESISTORS, ETC.)
TYPE "C" TEST - LIGHT WEIGHT EQUIPMENT

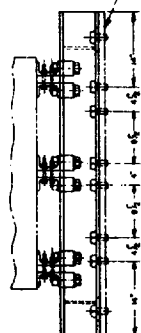
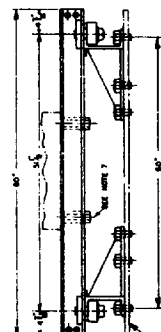
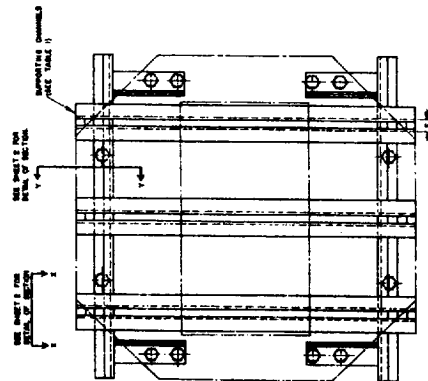
TABLE I

TABLE 1. NUMBER OF SUPPORTING 4" CAN BUILDING CHANNELS REQUIRED FOR A GIVEN EXCESSIVE WEIGHT AND SIZE.

[illegible]

NOTES

- [illegible]



TYPICAL MOUNTING ARRANGEMENTS

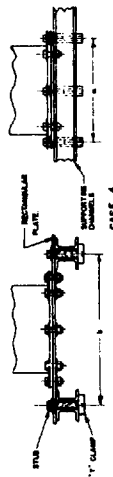
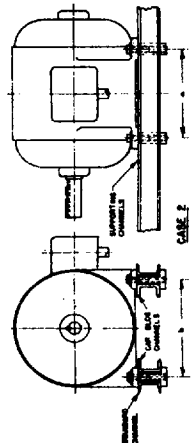
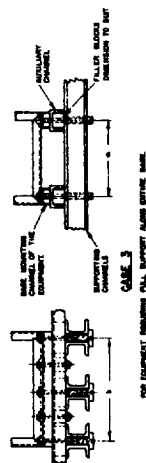
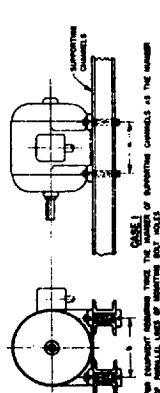
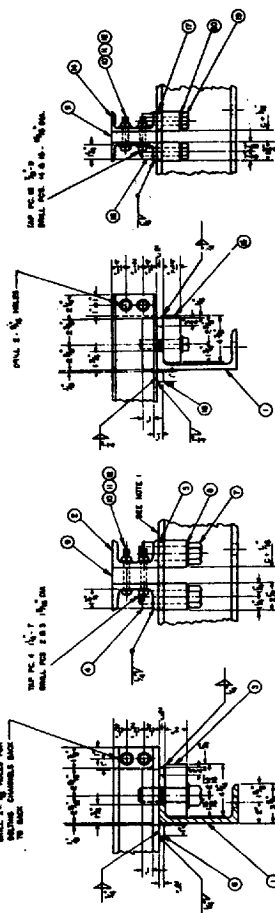
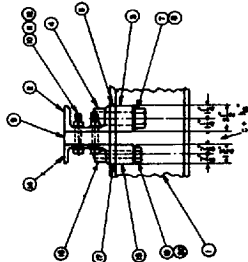


FIGURE 7A.—Standard mounting platform for testing equipment on medium-weight shock-testing machine.

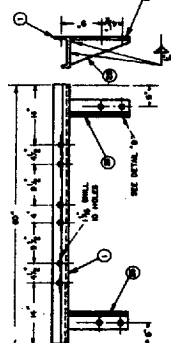
[illegible]

END CLAMP FOR 4" x 7.25" STANDARD CHANNELS

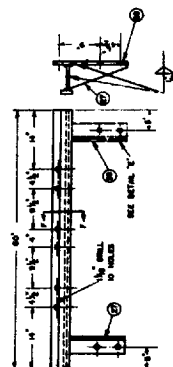
END CLAMP FOR 4" X 13.8" CAR BUILDING SUPPORTING CHANNELS



END CLAMP FOR CAR BUILDING SUPPORTING CHANNEL
AND STANDARD CHANNEL COMBINED



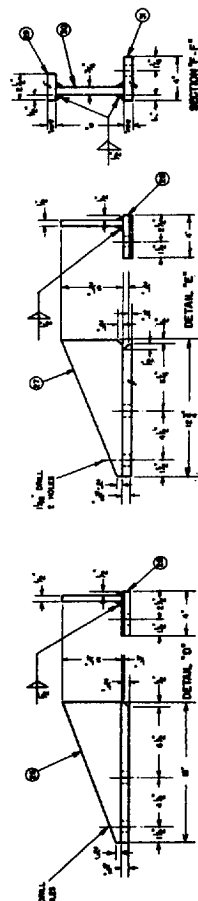
SHUTTLING DMS CHANNEL BASE



LUBRICATED CHANNEL BASE

10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

ST CLAMP USED TO SECURE EQUIPMENT TO SUPPORTING CHANNELS



DETAIL OF BRACE FOR FABRICATED CHANNEL

DETAIL OF BRACE FOR SHIPBUILDING CHANNEL.

FIGURE 7A.—Standard mounting platform for testing equipment on medium-weight shock-testing machine.

References

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AND STANDARDS
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MIL-S-901A

AMENDMENT 1

23 APRIL 1952

MILITARY SPECIFICATION

**SHOCKPROOF EQUIPMENT, CLASS HI (HIGH-IMPACT),
SHIPBOARD APPLICATION, TESTS FOR**

This amendment forms a part of Military Specification MIL-S-901A, 5 January 1952, and was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments.

Page 5, paragraph 4.6: Delete and substitute:

"4.6 Test records.—Shock tests performed at the manufacturer's plant shall be recorded on form NAVEXOS-3373 (see 6.4)."

Custodian:

Navy—Bureau of Ships

Other interest:

Navy—OrS

Air Force.

**SPECIFICATIONS
AND STANDARDS**

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AND STANDARDS**

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★ U. S. GOVERNMENT PRINTING OFFICE: 1952

MILITARY SPECIFICATIONS

SHOCKPROOF EQUIPMENT, CLASS HI (HIGH-IMPACT),
SHIPBOARD APPLICATION, TESTS FOR

This specification was approved by the Departments of the Army, the Navy, and the Air Force for use of procurement services of the respective Departments

1. SCOPE

1.1 Scope.—This specification covers the methods to be followed in conducting required high-impact shock tests on equipment for use on Naval vessels. These tests will be conducted for the purpose of determining the suitability of the equipment as regards the effects of severe shock liable to be incurred in wartime service.

1.2 Classification.—Tests for class HI shockproof equipment shall be of the following types as specified in the contract or order, or equipment specification (see 6.1):

Type A—For completely assembled apparatus (see 3.1.1).

Type B—For subassemblies (see 3.1.2).

Type C—For individual devices (see 3.1.3).

1.2.1 Weights.—The equipment shall be classified for the purpose of test as follows (see 6.1):

Light—Approximately 250 pounds and below (see 4.5.1.2).

Medium—Approximately 250 pounds to approximately 4,500 pounds (see 4.5.1.2).

Heavy—Above approximately 4,500 pounds.

2. APPLICABLE SPECIFICATIONS, STANDARDS, DRAWINGS, AND PUBLICATIONS

2.1 The following specifications and drawings, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

MILITARY

MIL-P-14—Plastic-Materials, Molding, and Plastic-Parts, Molded: Thermosetting.

MIL-B-857—Bolts, Nuts, Studs, and Tap Rivets (and Material for Same).

MIL-P-15035—Plastic-Material, Laminated, Thermosetting: Sheets, Cotton-Fabric-Base, Phenolic-Resin.

NAVY DEPARTMENT

General Specifications for Inspection of Material.

DRAWINGS

BUREAU OF SHIPS

10-T-2145-L—Shock-Testing Machine.

NO807-655947—HI Shock-Testing Machine, Medium-Weight, Outline Thirty Sheets.

(Copies of specifications, standards, and drawings required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Definitions.—

3.1.1 Type A.—The type A test is the preferred type of test and should be specified whenever a testing machine of sufficient capacity to handle the completely assembled apparatus is available.

3.1.2 Type B.—The type B test should be specified only in those cases when a testing machine of sufficient capacity to handle the completely assembled apparatus is not available. The type B test is applicable to subassemblies of a complete device; for example, the rotor of a motor or generator, the throttle trip valve and associated overspeed trip mechanism of a turbine, the lamp of a searchlight, or a single cubicle of a switchboard unit con-

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taining several draw-out circuit-breakers. Inasmuch as the type B test applies to sub-assemblies having specific applications, the approval under this test will be limited to the specific application.

3.1.3 Type C.—The type C test has wide application to the testing of numerous individual devices having a variety of shipboard applications. The type C test is intended to apply to individual devices such as instruments, circuit-breakers, controller components, motors, resistors, rheostats, relays, meters, turbines, and other devices that may be employed in a variety of applications with the result that the method of mounting in service may vary widely, depending upon the application. A device approved under the type C test may be applied in an accepted manner aboard ship, subject to any limitations specified in the approval letter. An apparatus which is composed entirely of components which have satisfactorily passed the type C test may not require either the type A or B test, subject to approval of the assembly and mounting details of the components and supporting structure by the Government inspector and the bureau or agency concerned.

3.1.4 Medium-weight.—The 4,500-pound limit for the medium-weight classification is based on a weight of mounting platform of 1,100 pounds for the medium-weight shock-testing machine. Equipment of greater weight should be classified as medium-weight equipment, when the total weight of equipment plus mounting does not exceed 5,600 pounds.

3.1.5 Heavy-weight.—Equipment in the "heavy" classification will be given the type A test when Navy standard testing machines are available for this purpose.

3.1.6 Shockproof equipment.—Shockproof equipment is defined as a design which will continue to perform its principal functions (see 6.1) throughout and after the application of shock of established magnitude by standard Navy shock testing machines. Equipment whose satisfactory performance under shock is dependent upon shock mountings which are either an integral or nonintegral part of the equipment shall not be considered as shockproof. This restriction applies primarily to

shock mounts which require maintenance and are subject to deterioration.

3.2 Material.—

3.2.1 Steel and copper-base alloys are the preferred materials for noninsulating parts, and laminated cloth reinforced plastics the preferred material for insulating parts. Cast iron shall not be used as a material of construction. Molded plastic materials should be judiciously employed: when used, CFI types or an equivalent impact strength MFI type as specified in Specification MIL-P-14 should be employed wherever practicable. Except in cases where the specification covering the equipment being shock-tested so permits or where specific bureau or agency approval has been granted, ebony asbestos, porcelain, glass die castings, zinc castings, cast and wrought aluminum, and all other materials of low strength and ductility shall not be used in class HI equipment.

3.2.2 The final acceptance of the material will, in all cases, be contingent upon satisfactory performance under the shock test at the specified testing activity. The material shall be such as to insure satisfactory operation under conditions of class HI mechanical shock as specified hereinafter.

3.3 Basis of acceptability.—Acceptability will be contingent upon the equipment withstanding the shock resulting from the test specified in 4.5. During or subsequent to the test the apparatus shall not fail to perform its principal functions. Failure to perform its principal functions is defined as failure of the tested apparatus to function satisfactorily as specifically defined for the particular apparatus in the specification covering the equipment, the contract, or order, as applicable. None of the parts or objects shall become detached from the apparatus. Equipment mounting bolts shall not fail nor show appreciable loosening due to stretching. Minor chipping of parts such as plastic knobs and cases and minor distortion of parts will be permitted where such chipping or distortion cannot in any manner impair the operation of any parts. The apparatus shall not require any attention or adjustment or replacement of parts to enable it to perform its principal functions during and after each blow of the test.

3.4 Marking.—Equipment which passes these tests shall be designated as follows:

Notes for drawings.—

This equipment has been accepted as Navy class HI shockproof equipment (Spec. MIL-S-901) by (bureau or agency) letter _____.

This equipment has been successfully tested for Navy class HI shock (Spec. MIL-S-901), at the place of manufacture, as reported by Inspector of Material letter _____. Bureau or agency acceptance not yet granted.

Name-plates.—

The Navy class HI shockproof designation may be placed upon the name-plate of the equipment only after specific bureau or agency acceptance; this acceptance may be based on the results of inspector-witnessed factory tests.

Articles which are to be shock-tested and retained by the Government shall be provided with name-plates having the same information as those in the lot from which the test samples are taken. In addition, the test samples shall be provided prior to the test with distinctive name-plates, adjacent to the regular name-plates, which shall have the following wording in light letters on a red background:

CAUTION

Substandard Unit

Unit has been class HI shock tested and possibly damaged. To be used only at specific direction of bureau or agency concerned _____.

3.5 Workmanship.—The workmanship shall be such as to insure satisfactory operation under conditions of class HI mechanical shock as specified herein.

4. SAMPLING, INSPECTION, AND TEST PROCEDURES

4.1 Inspection procedures.—For Naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

4.2 Standard Navy shock-testing machines.—The shock-testing machine for lightweight equipment shall be constructed in accordance with Drawing 10-T-2145-L as shown on figure 1. The shock-testing machine for medium weight equipment, shown on figure 2, shall be constructed in accordance with Drawing NO807-655947. For heavy equipment the shock-testing machine shall conform to the requirements to be developed for this machine.

4.3 Types of assemblies.—

4.3.1 Completely assembled apparatus (type A).—The completely assembled apparatus to be tested shall be mounted on the shock machine in a manner simulating the most severe (as regards shock) method that will be used aboard ship. (See 4.4.) This mounting is generally specified in the specification covering the equipment. The mounting feet, bolt holes, or other means provided for securing the apparatus when installed on shipboard, shall be used in mounting the apparatus for the shock test.

4.3.2 Subassemblies (type B).—The subassemblies shall be mounted in a manner which is approved as being dynamically equivalent to the mounting provided when they are assembled to form the complete apparatus. (See 3.1.2.)

4.3.3 Individual devices (type C).—Individual devices shall be subjected to shock tests only if they will have general applications. Such devices shall be mounted on the test machine, using the normal mounting provisions of the device. (See 3.1.3.)

4.4 Methods of mounting.—

4.4.1 Lightweight equipment.—The shock machine for lightweight equipment is provided with the anvil plate shown on figure 3. Unless otherwise specified in the contract or order, or the equipment specification, the apparatus to be tested shall be mounted by means of standard mountings, the plans for which are shown on figures 4A, 4C, 6D (sheets 1 and 2), and 6E.

4.4.1.1 An item of equipment that has passed the shock test when mounted on figure 4A or 4C mounting, as appropriate, need not be retested for applications where the figure 6E mounting would ordinarily be required. For example, a switch that has passed tests on the figure 4A or 4C mounting need not be retested on the 6E mounting if it is to be utilized as a controller component. When an item of equip-

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ment has passed shock tests mounted on the figure 6D or 6E mounting, it shall be limited to applications for which these mountings are appropriate. Where a specific test mounting is designated in the particular equipment specification, that mounting shall be utilized in all instances unless exception is made by the bureau or agency concerned.

4.4.1.2 When the equipment has been mounted for a test upon a standard mounting, its position upon the standard mounting shall not be changed during the course of the test.

4.4.1.3 There shall be no variation in the construction of these standard mountings without specific approval of the bureau or agency concerned. In the event that none of the standard mountings can be utilized for a particular piece of equipment, or if there is some doubt as to which mounting is applicable, the bureau or agency concerned shall be consulted to determine an appropriate mounting. It is the intent of these standard mountings to appropriate the actual rigidity encountered aboard ship in the utilization of the particular equipment.

4.4.1.4 Mounting bolts for fastening the equipment shall conform to type A or B, class B of Specification MIL-B-857.

4.4.2 Medium-weight equipment.—The shock machine for testing medium-weight equipment is shown on figure 2. The equipment shall be attached to the anvil table of the machine by means of a standard mounting platform specified herein, or a mounting adaptor satisfactory to the bureau or agency concerned. In general, the adaptor should provide a stiffness approximately equivalent to the most rigid mounting on which the equipment would normally be placed aboard ship. In no case shall the equipment be mounted directly to the anvil table. The standard mounting platform shown on figure 7A is approved for use where applicable; however, mounting adaptors differing from figure 7A shall be used when specified in the equipment specification, contract or order. Mounting bolts for fastening the equipment shall conform to type A or B, class B of Specification MIL-B-857.

4.4.3 Heavy equipment.—For heavy equipment, the method of mounting shall conform

to the requirements to be developed for such method.

4.5 Test procedure.—The apparatus or equipment shall be tested in each of its principal operating conditions subject to shock in service; for example, motors shall be tested running at rated speed and at standstill, and contactors shall be tested in the open and closed position. Unless otherwise specified in the contract or order or the equipment specification, the procedure shall be as follows:

4.5.1 For lightweight equipment.—

4.5.1.1 A total of nine blows shall be applied, employing the machine shown on figure 1. Three blows shall be applied parallel to each of three principal axes of the apparatus being tested, the three blows for each direction to be with heights of hammer drop of 1 foot, 3 feet, and 5 feet. For lightweight equipment having two or more electrical or mechanical operating conditions (e. g., circuit breakers and switches), the nine blows shall be delivered for each condition; separate items of equipment may be submitted for each series of nine blows if desired by the manufacturers.

4.5.1.2 Equipment within the range of 250 to 400 pounds may be tested on the light-weight machine at the discretion of the manufacturer, unless otherwise specified by the bureau or agency concerned. Requests for class HI shock tests on equipment in this weight range shall indicate whether tests are desired on the light or medium-weight machine. A note shall also be incorporated on the applicable plan indicating the shock machine utilized.

4.5.2 For medium-weight equipment.—The tests shall be made on the medium-weight shock machine shown on figure 2, and a total of six blows shall be applied to the equipment. The six blows shall consist of three groups of two blows each. For each group, the height of hammer drop and the initial up travel of the anvil table shall be as shown in table I.

4.5.3 For heavy-weight equipment.—Procedure will be established when the testing machine becomes available.

4.5.4 General.—

4.5.4.1 Unless otherwise approved by the bureau or agency concerned, electrical circuits at rated voltage values (and rated current, when practicable) for the equipment under test

TABLE I.—Height of Hammer drop, feet.

Group number.....	I	II	III
Number of blows.....	2	2	2
Anvil table travel, inches.....	3	3	1½
Total weight on anvil table, pounds:			
250-1,000.....	0.75	1.75	1.75
1,000-2,000.....	1.0	2.0	2.0
2,000-3,000.....	1.25	2.25	2.25
3,000-3,500.....	1.5	2.5	2.5
3,500-4,000.....	1.75	2.75	2.75
4,000-4,200.....	2.0	3.0	3.0
4,200-4,400.....	2.0	3.25	3.25
4,400-4,600.....	2.0	3.5	3.5
4,600-4,800.....	2.25	3.75	3.75
4,800-5,000.....	2.25	4.0	4.0
5,000-5,200.....	2.5	4.5	4.5
5,200-5,400.....	2.5	5.0	5.0
5,400-5,600.....	2.5	5.5	5.5

Note 1.—Total weight on anvil table is the sum of equipment weight plus weight of mounting.

Note 2.—The height of hammer drop shall be measured by means of the existing markings on the scale of the machine, no corrections being made for the added anvil table travel for the blows of groups I and II.

shall be established during the test and records made by suitable means of both "make" and "break" in the circuit which can be attributed to shock.

4.5.4.2 Cable, bus, pipe, or shaft connections to the apparatus under test shall be sufficiently flexible to prevent attenuation of the shock imparted to the apparatus by the test machine.

4.5.4.3 All mounting bolts of the apparatus and shock-machine mounting shall be tightened before each test blow is delivered.

4.5.4.4 The motion of the equipment under test shall be recorded for each blow in each direction, when and as specified by the bureau or agency concerned.

4.5.4.5 The over-all dimensions, the weight, and the approximate location of the center of gravity of the equipment, together with a sketch of the method of mounting on the shock-testing machine, shall be recorded.

4.5.4.6 The test report shall include detailed descriptions of any damage incurred after each blow, and, where practicable, photographs showing the damage incurred should supplement this description. Also copies of the records obtained under 4.5.4.1, 4.5.4.4 and 4.5.4.5 shall be included in the report.

4.5.4.7 After completion of the shock test the apparatus or equipment shall be given suitable tests to determine whether or not it performs its principal functions as specified in 3.3. When applicable, the equipment or apparatus shall be subjected to a dielectric test consisting of a 1-minute application of an alternating-current voltage having a value of 65 percent of the dielectric test voltage specified

in the equipment specification or the contract or order. No insulation breakdown shall occur. For equipment on which hydraulic pressure tests are required to determine conformance with 3.3, such tests shall be made at the pressure specified for routine tests in the equipment specification.

4.5.5 Disposition of shock-tested equipment.—

4.5.5.1 Because of possible damage sustained during the shock test, articles subjected to the high-impact shock test will not be acceptable either as a whole or as a part assembled with other nontested articles to form a unit of equipment, and shall be discarded unless retained by the Government under the terms of the contract or order as specifically authorized by the bureau or agency concerned.

4.5.5.2 When a test sample has satisfactorily passed the shock test and is to be retained by the Government, the manufacturer shall thoroughly inspect the sample, correct all minor damage which may have occurred during the test, and then deliver the tested sample to the Government inspector for disposition as directed by the bureau or agency concerned.

4.6 Test records.—Shock tests shall be recorded on form NAVEXOS-3373. (See 6.4.)

5. PREPARATION FOR DELIVERY

5.1 There are no packaging, packing, and making requirements applicable to this specification.

6. NOTES

6.1 Ordering data.—Requests, requisitions, schedules, contracts or orders, and specifications should specify the following, when the equipment is required to be Navy class HI shock-proof:

- Title, number, and date of this specification.
- The required type of shock test. (See 1.2.)
- The weight designation of the shock test. (See 1.2.1.)
- Principal functions of the equipment or apparatus. (See 3.1.6.)
- A definition of "failure to perform principal functions." (See 3.3.) Permissible minor adjustments which may be made either during or at the conclusion of the shock test.

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- (f) Description or designation of acceptable method of mounting the equipment on the shock-testing machine for test. (See 4.4.)
- (g) Exceptions to this specification, if any.
- (h) The place at which the shock test will be conducted, i. e., at a Government laboratory designated by the bureau or agency concerned or at the place of manufacture, or at both.
- (i) The number of individual articles from each manufacturing lot to be tested.
- (j) Disposition of shock tested samples. (See 4.5.5.)

6.2 General information.—

6.2.1 The following information is listed herein for the assistance of the designer and, in those cases where equipment cannot be shock tested, for the assistance of the Government agency approving drawings prior to manufacture:

- (a) The deflection of semi-rigid parts under shock is quite large and accordingly there should be ample clearances to prevent electrical short circuits and impact damage.
- (b) Desirable material properties are strength, ductility, and, in some cases, low density. Undesirable properties are brittleness, low impact resistance, and high notch sensitivity.
- (c) In the application of material, ample cross sections should be provided and factors causing stress concentration such as sharp corners and sudden changes in cross section should be avoided.
- (d) In the design of mechanisms (e. g., voltage regulators and relays) well constructed elastic hinges or shafts and bearings are preferred to knife-edge pivots.
- (e) Riveted joints, or screws and bolts with heads formed by extreme cold-working should not be used. When bolted joints are employed, the bolts should have a minimum clearance in the holes; or dowels should be used. Welded and brazed joints are the most satisfactory.

- (f) Levers, linkages and other moving parts of mechanisms should be balanced (either individually or in groups), whenever practicable, in order to reduce the tendency to maloperation under shock.

6.2.2 This specification is very general, so as to cover the entire field of shipboard equipment and apparatus, except certain electronic and navigational equipment for which other specifications are applicable. In order to apply this specification properly, it is necessary to specify separately, describe, or define the features enumerated in 6.1.

6.2.3 Equipment approved on the basis of the previous edition of this specification will retain approval until such time as tests on the basis of this edition proved the equipment to be unsatisfactory.

6.3 Enlarged copies of figures 4A, 4C, 6D, 6E, and 7A will be supplied by the Bureau of Ships upon request.

6.4 Test record.—The applicable test record form is NAVEXOS-3373, Factory Test Record, Class HI Shock. Pads of these forms may be obtained upon application to the Government inspector, except that activities of the Armed Forces should make application to the Commanding Officer, Naval Supply Depot, Scotia 2, N. Y. When requesting pads, refer to both the title and number. (See 4.6.)

6.5 Superseding documents.—This specification supersedes MIL-S-901(SHIPS). The latter superseded Navy Specification 66S3.

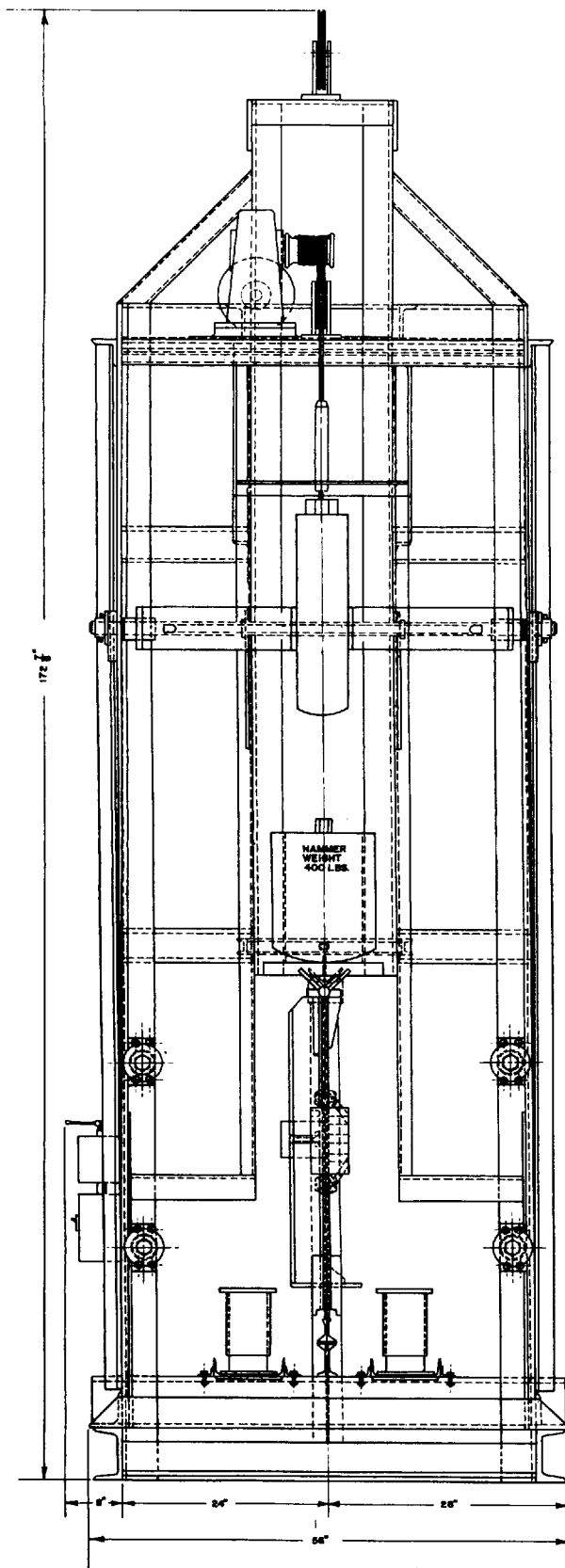
Notice.—When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:

Navy—Bureau of Ships

Other interest:

Navy—OrS
Air Force.



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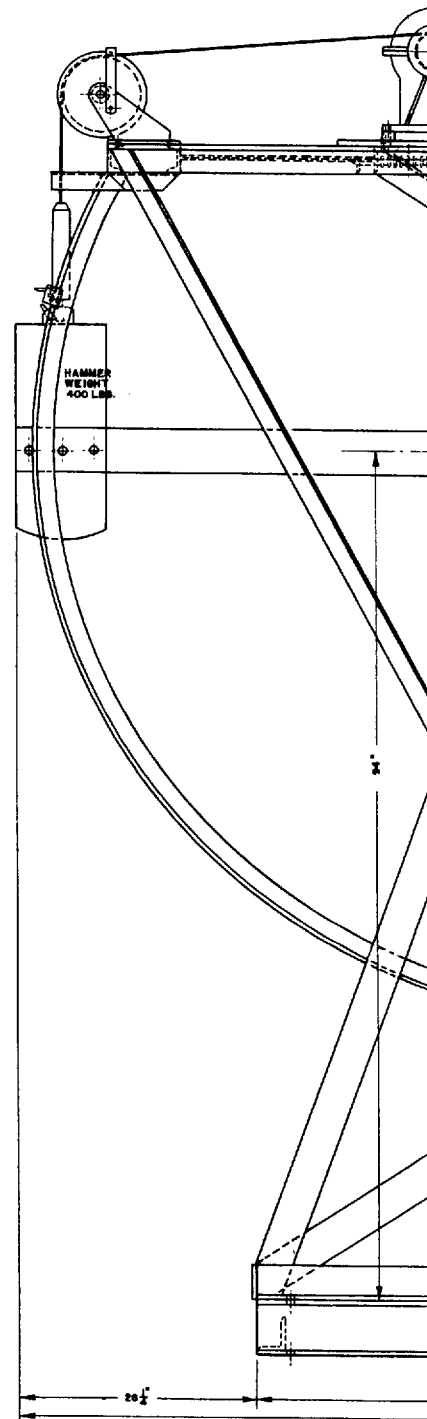
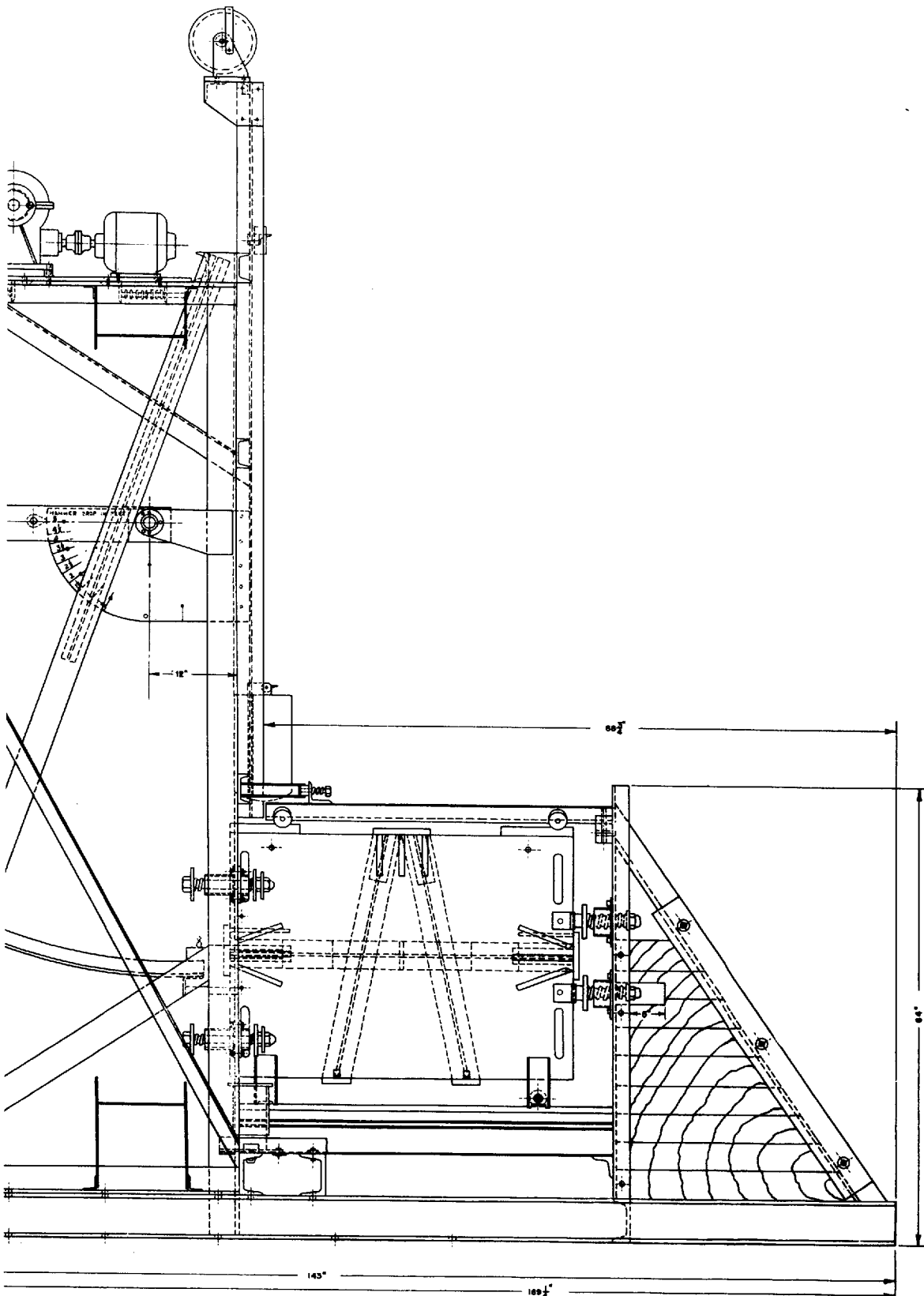


FIGURE 1.—Shock-testing ma

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chine for light-weight equipment.

952175 O - 52 (Face p. 6) No. 1

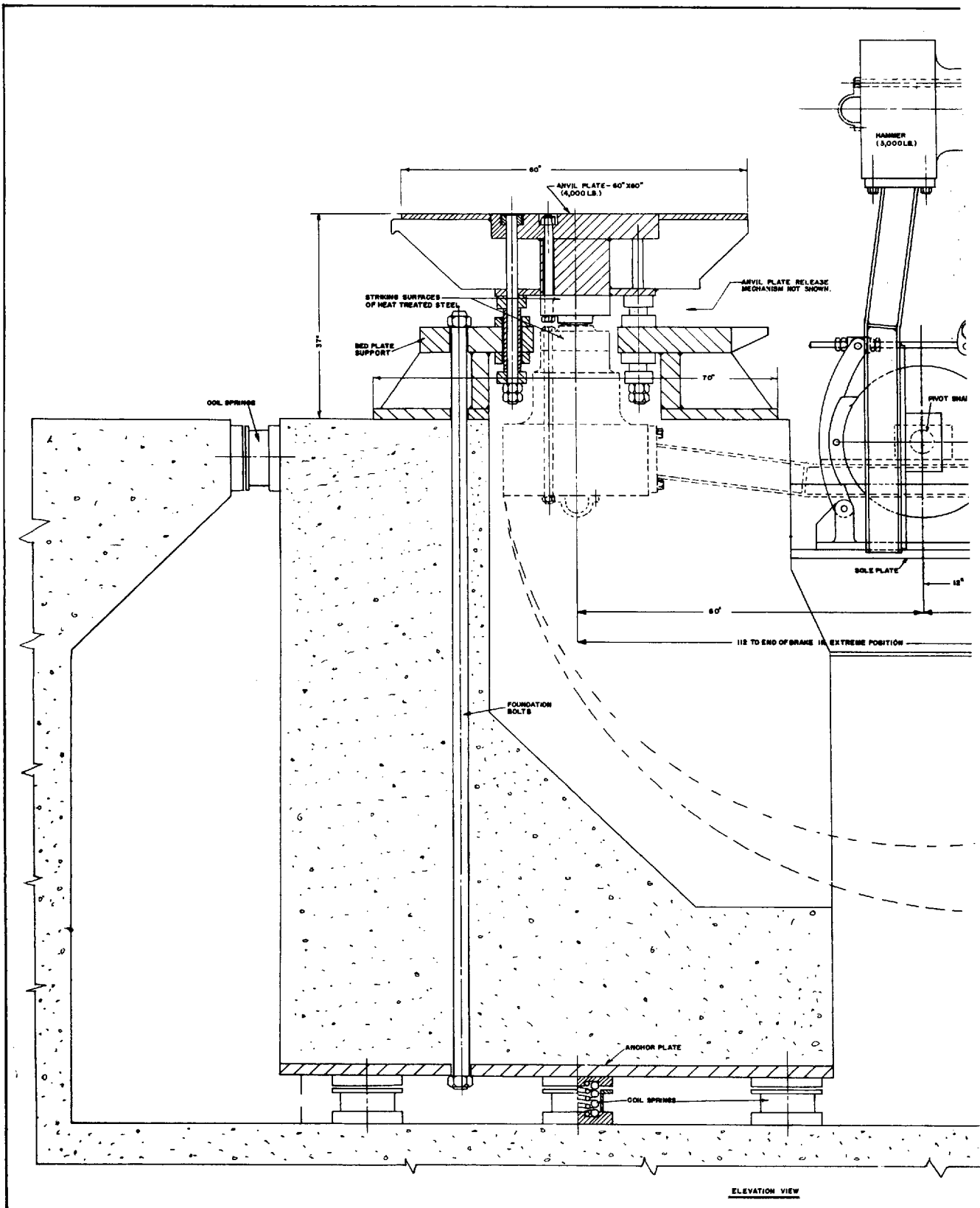
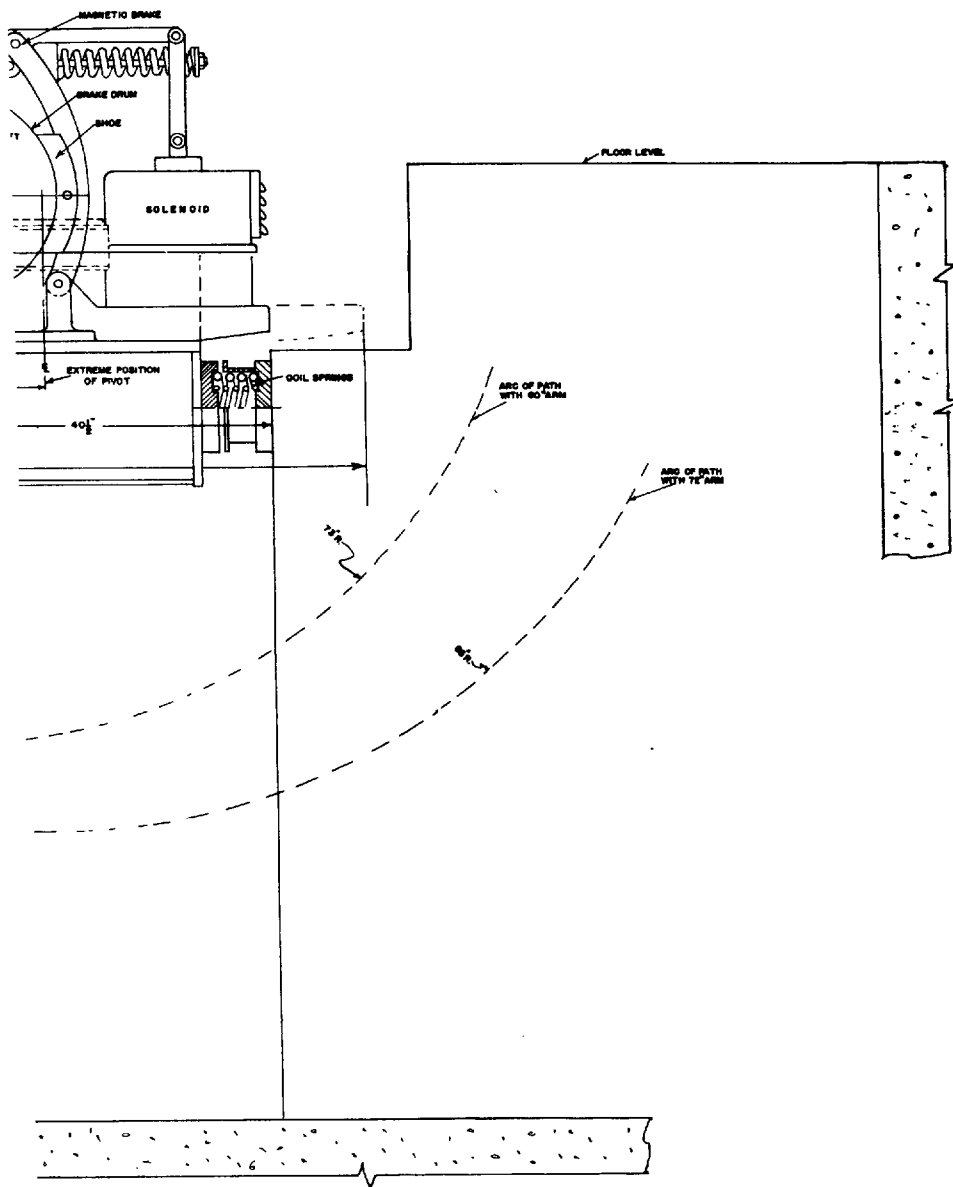
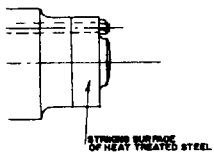


FIGURE 2.—Shock-testing machine for

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medium-weight equipment.

952175 O - 52 (Face p. 6) No. 2

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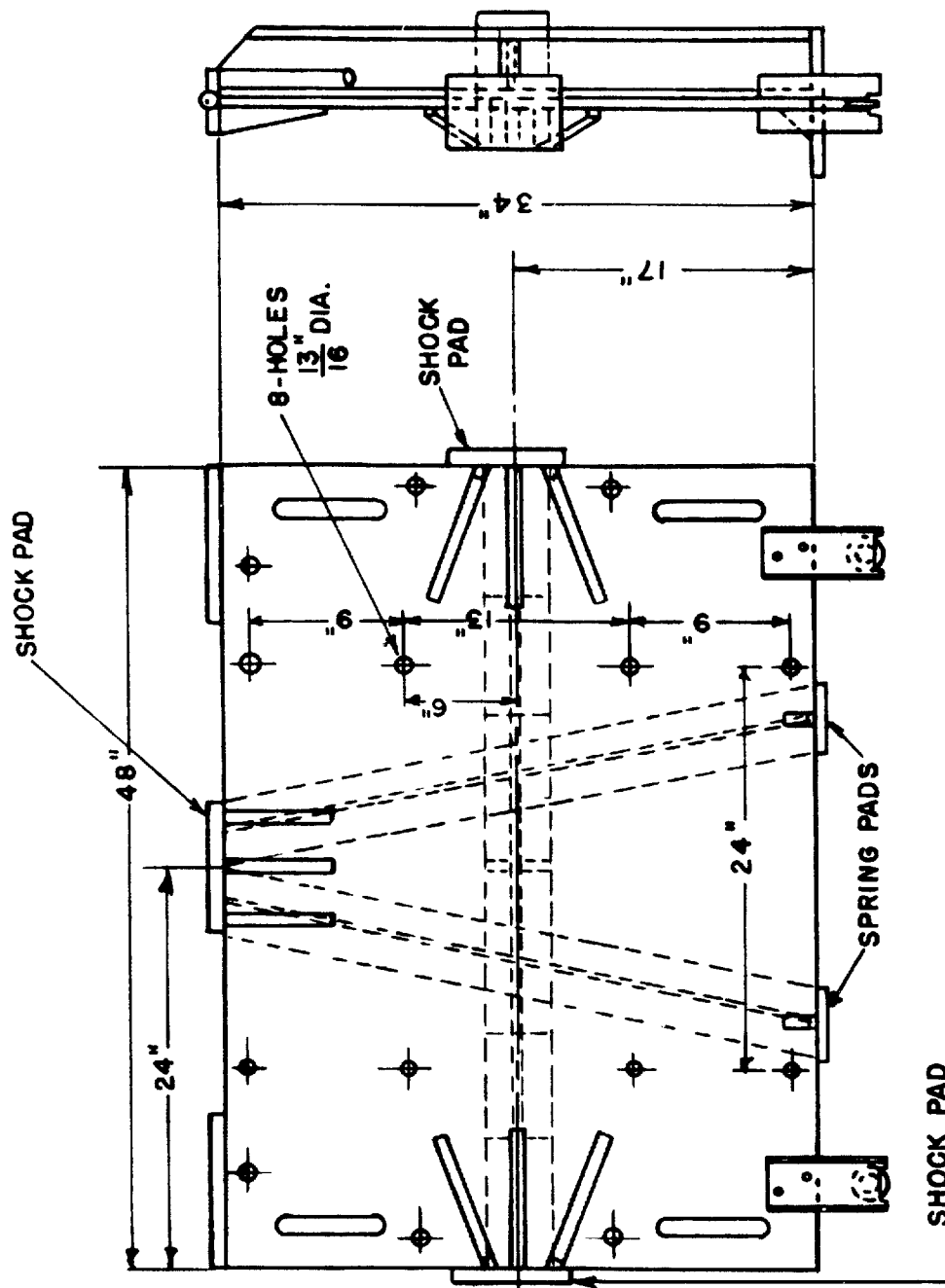


FIGURE 3.—Anvil plate of shock-testing machine for light-weight equipment.

952175 O - 52 (Face p. 6) No. 3

LIST OF MATERIAL

QUANTITIES ARE FOR: ONE MOUNTING

PIECE NUMBER	NAME OF PIECE	NO. REQD.	MATERIAL SPECIFICATION	FINISH
1	CAR BUILDING CHANNEL - 4" X 13.8"	1	STEEL	
2	CAR BUILDING CHANNEL - 4" X 13.8"	1	STEEL	
3	AUXILIARY MOUNTING PLATE	1	STEEL	
4	SPACER (SEE TABLE 1 FOR SIZE)	1/ROD	STEEL	
5	2"-10 X 7" LG. HEX. HD. BOLT	8	STEEL (HEAT TREATED)	
6	2"-10 HEX. HD. NUT	8	STEEL (HEAT TREATED)	
7	WASHER - 2" O.D. X 1/8" I.D.	16	STEEL	
8	1" STD. PIPE SPACER - 2 1/2" LG.	8	STEEL	

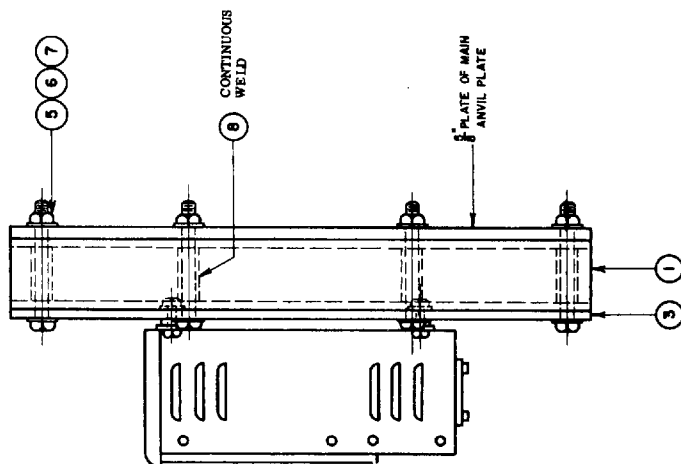
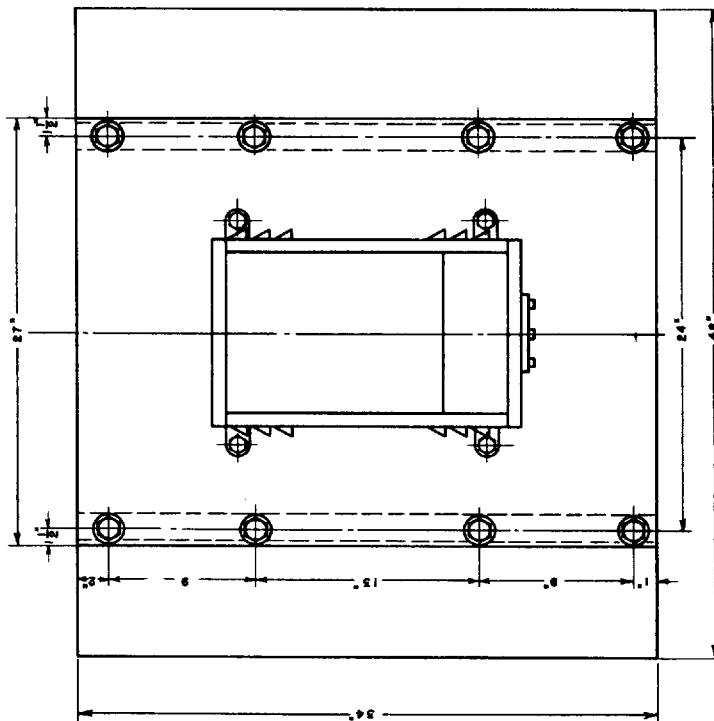
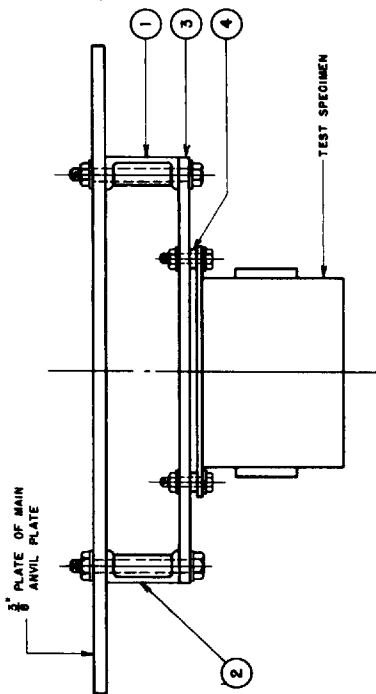
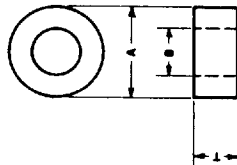


TABLE 1

BOLT SIZE	SPACER DIMENSIONS		
	A	B	T
$\frac{1}{4}$ "	$\frac{3}{4}$ "	$\frac{9}{32}$ "	$\frac{5}{8}$ "
$\frac{5}{16}$ "	$\frac{3}{4}$ "	$\frac{11}{32}$ "	$\frac{5}{8}$ "
$\frac{3}{8}$ "	$\frac{7}{8}$ "	$\frac{13}{32}$ "	$\frac{5}{8}$ "
$\frac{1}{2}$ "	$1\frac{1}{4}$ "	$\frac{9}{16}$ "	$\frac{1}{2}$ "
$\frac{5}{8}$ "	$1\frac{1}{2}$ "	$\frac{11}{16}$ "	$\frac{5}{8}$ "
$\frac{3}{4}$ "	$1\frac{3}{4}$ "	$\frac{13}{16}$ "	$\frac{3}{4}$ "

SPACERS TO BE USED WHEN SECURING
EQUIPMENT TO THE $\frac{1}{2}$ " AUXILIARY
MOUNTING PANEL.



NOTES -

1. THE SIZE OF THE AUXILIARY MOUNTING PLATE, PC-3, MAY BE INCREASED, IN WIDTH ONLY, FROM 27" TO A MAXIMUM OF 36" AS REQUIRED FOR LARGE ITEMS OF EQUIPMENT.
2. ONE SPACER OF THE SIZE INDICATED IN TABLE 1 SHALL BE UTILIZED FOR EACH EQUIPMENT MOUNTING BOLT.

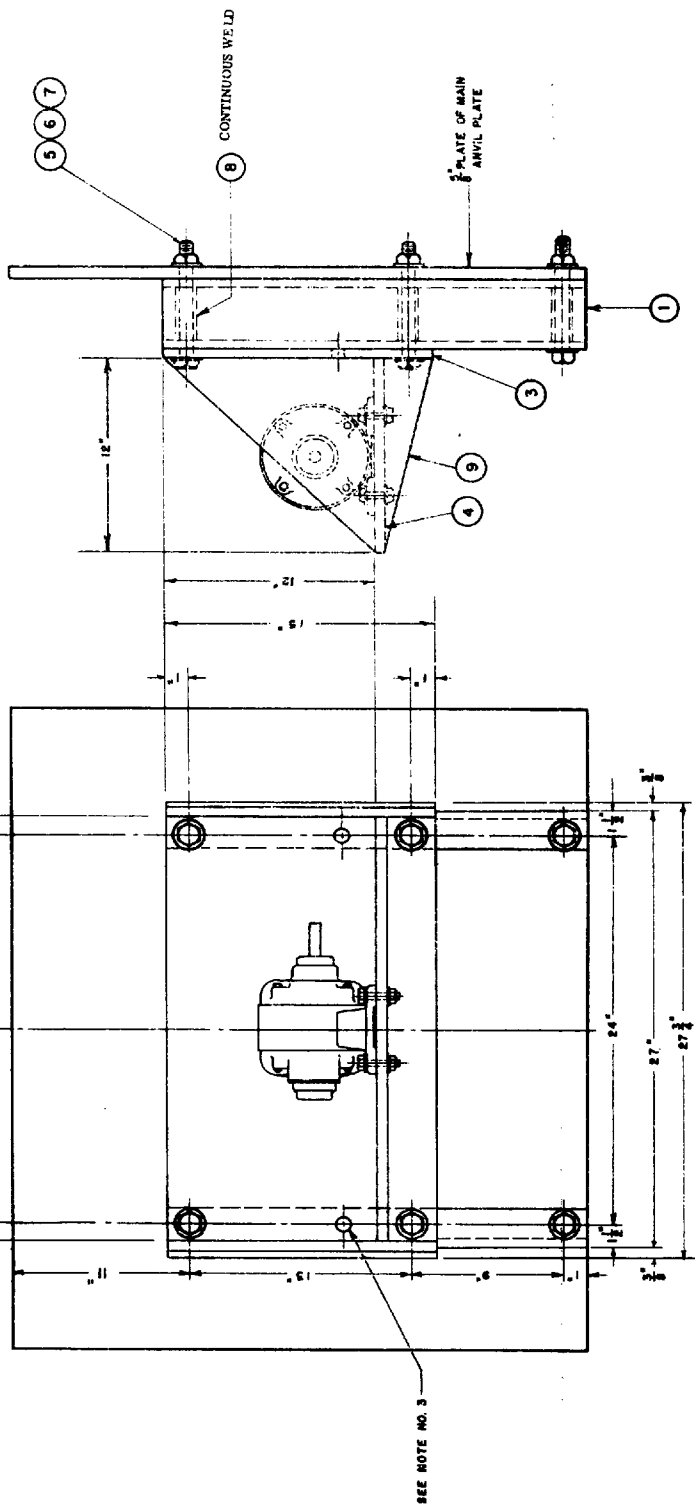
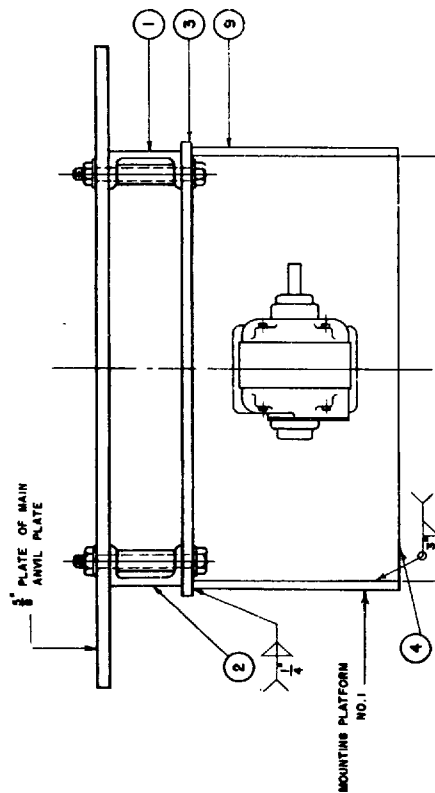
FIGURE 4A.—Standard mounting for bulkhead mounted equipment: Type "A" test—Light-weight equipment.

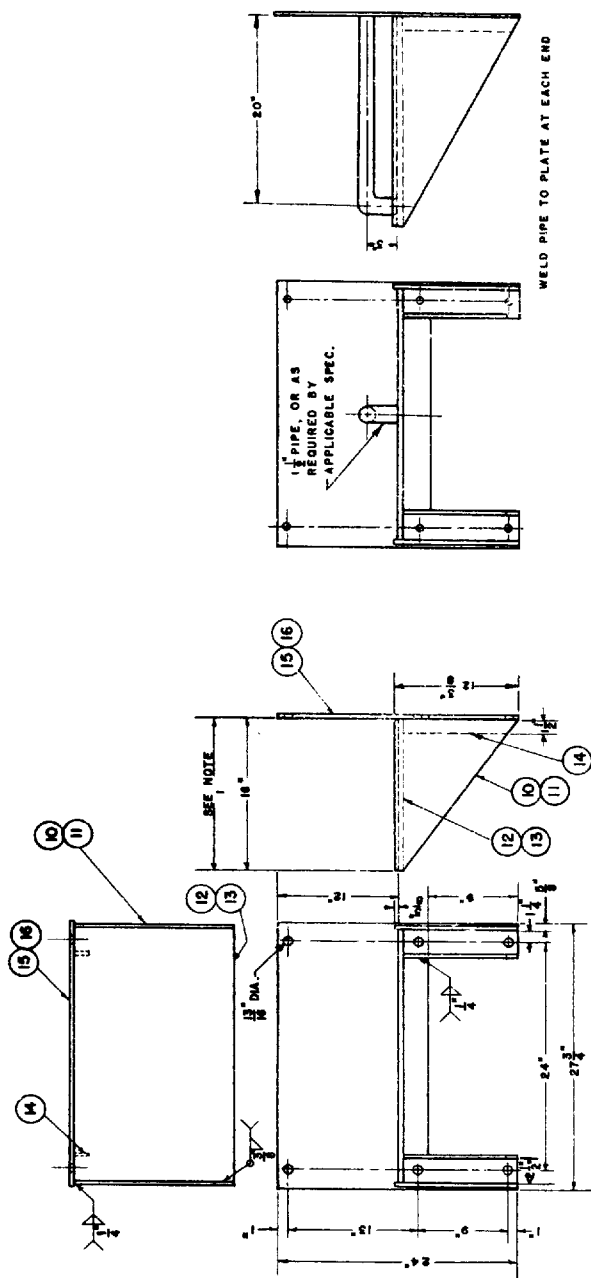
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LIST OF MATERIAL

QUANTITIES ARE FOR: THREE MOUNTINGS

PIECE NUMBER	NAME OF PIECE	NO. REQD.	MATERIAL SPECIFICATION	MATERIAL FINISH
1	CAR BUILDING CHANNEL - 4" X 13.8"	1	STEEL	
2	CAR BUILDING CHANNEL - 4" X 13.8"	1	STEEL	
3	AUXILIARY MOUNTING PLATE	1	STEEL	
4	HORIZONTAL MOUNTING PLATE	1	STEEL	
5	10 X 7" LG. HEX. HD. BOLT	6	STEEL	
6	10 X 7" LG. HEX. HD. BOLT	6	STEEL	
7	WASHER - 2" O.D. X 1/8" I.D.	12	STEEL	
8	1" STD. PIPE SPACER - 8 1/2" LG.	6	STEEL	
9	RUSSET PLATE	2	STEEL	
10	RUSSET PLATE	2	STEEL	
11	RUSSET PLATE	2	STEEL	
12	HORIZONTAL MOUNTING PLATE	1	STEEL	
13	HORIZONTAL MOUNTING PLATE	1	STEEL	
14	STIFFENERS	4	STEEL	
15	AUXILIARY MOUNTING PLATE	1	STEEL	
16	AUXILIARY MOUNTING PLATE	1	STEEL	





MOUNTING PLATFORM NO. 2

MOUNTING PLATFORM NO. 3 ADAPTED
FOR RAIL CLAMP SEARCHLIGHTS

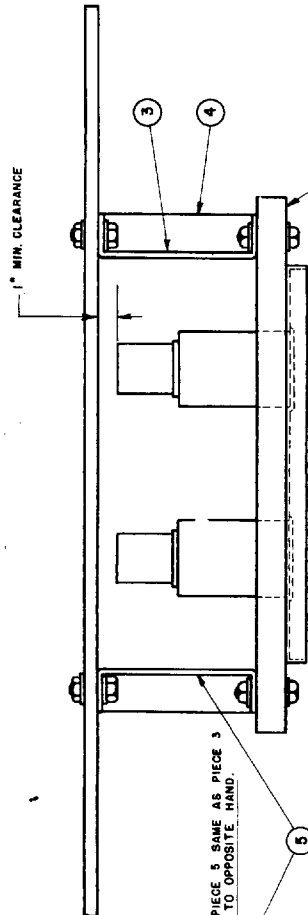
NOTES:

1. ALL TOLD THERE ARE THREE MOUNTING PLATFORMS. MOUNTING PLATFORM NO. 3 IS TO BE SIMILAR TO MOUNTING PLATFORM NO. 2 WITH THE EXCEPTION THAT THE DEPTH OF THE HORIZONTAL MOUNTING PLATE AND THE SIDE GUSSET PLATES SHOULD BE INCREASED TO 24".
2. THE SMALLEST MOUNTING PLATFORM SHOULD BE SELECTED WHICH WILL SATISFACTORILY ACCOMMODATE THE EQUIPMENT.
3. IF THE DEEP GUSSETS INTERFERE WITH MOUNTED EQUIPMENT, THE EXTRA BOLT HOLES SHOULD BE USED IN BOLTING MOUNTING PLATFORM NO. 1 IN THE INVERTED POSITION TO THE FOUR LOWER BOLT HOLES OF THE ANVIL PLATE.

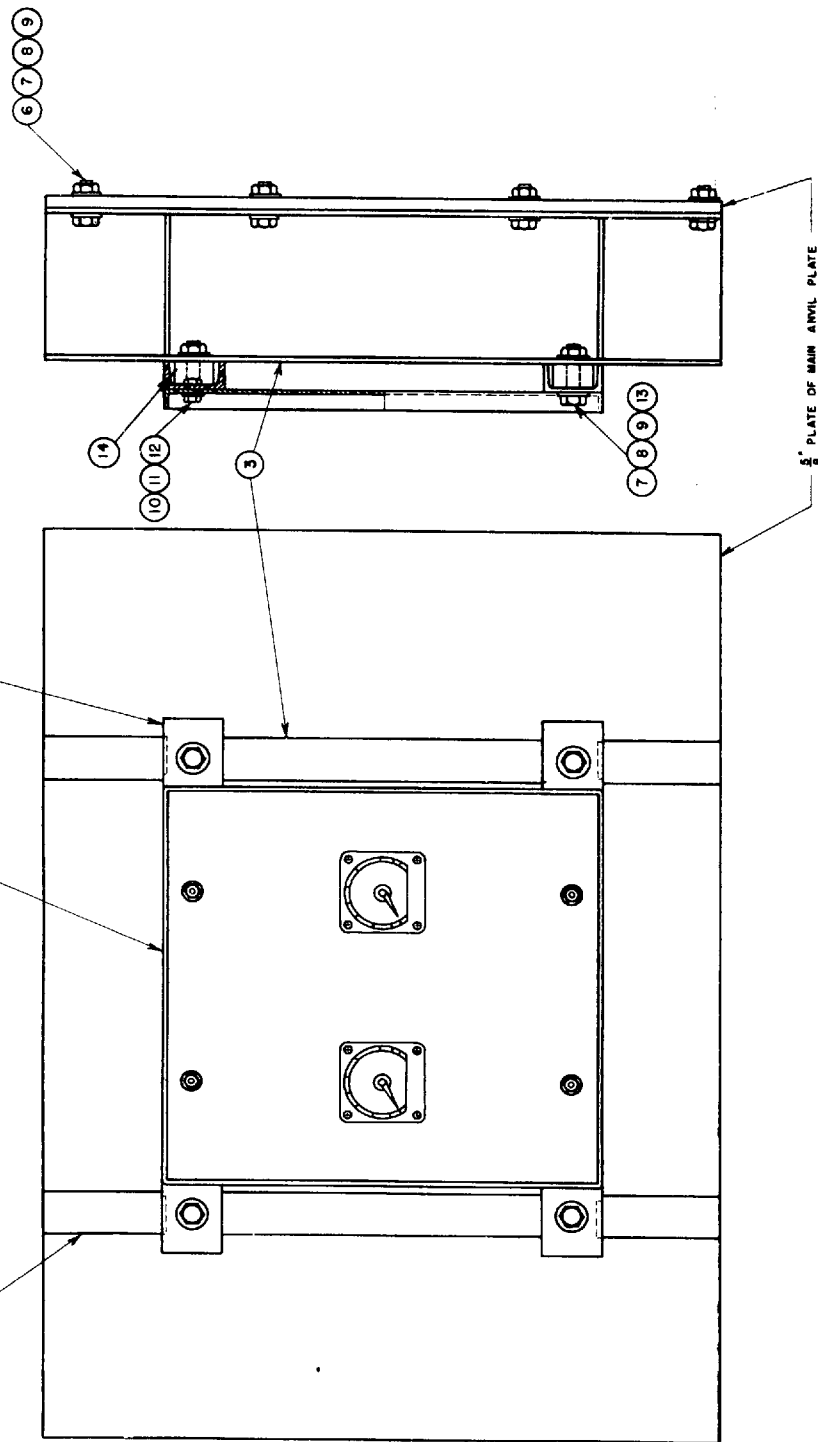
FIGURE 4C.—Standard mounting for deck or platform mounted equipment: Type "A" test—Light-weight equipment.

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LIST OF MATERIAL				
QUANTITIES ARE FOR ONE MOUNTING				
PIECE NUMBER	NAME OF PIECE	NO. REQD.	MATERIAL	MATERIAL SPECIFICATIONS
1	PANEL	1	STEEL	
2	STANDARD CHANNEL - 3" X 5 1/2"	2	STEEL	
3	FABRICATED SPACER	1	STEEL	
4	SPACER STIFFENER	4	STEEL	
5	FABRICATED SPACER	1	STEEL	
6	2-10 X 1 1/2 LG. HEX. HD. BOLT	8	STEEL	
7	2-10 HEX. HD. NUT	12	STEEL	
8	WASHER - 2" O.D. X 1/8" I.D.	12	STEEL	
9	WASHER - 1 1/2" O.D. X 1/8" I.D.	12	STEEL	
10	2-13 X 1" LG. HEX. HD. BOLT	4	STEEL	
11	2-13 HEX. HD. NUT	4	STEEL	
12	WASHER - 1 1/2" O.D. X 1/8" I.D.	4	STEEL	
13	2-10 X 1 1/2 LG. HEX. HD. BOLT	4	STEEL	
14	BLOCK - 2 1/4" X 2" X 1 1/2"	4	STEEL	



NOTE: PIECE 5 SAME AS PIECE 3 EXCEPT TO OPPOSITE HAND.



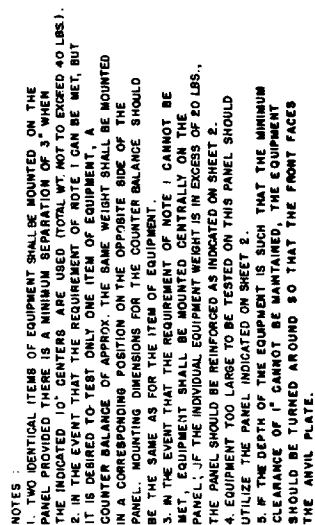
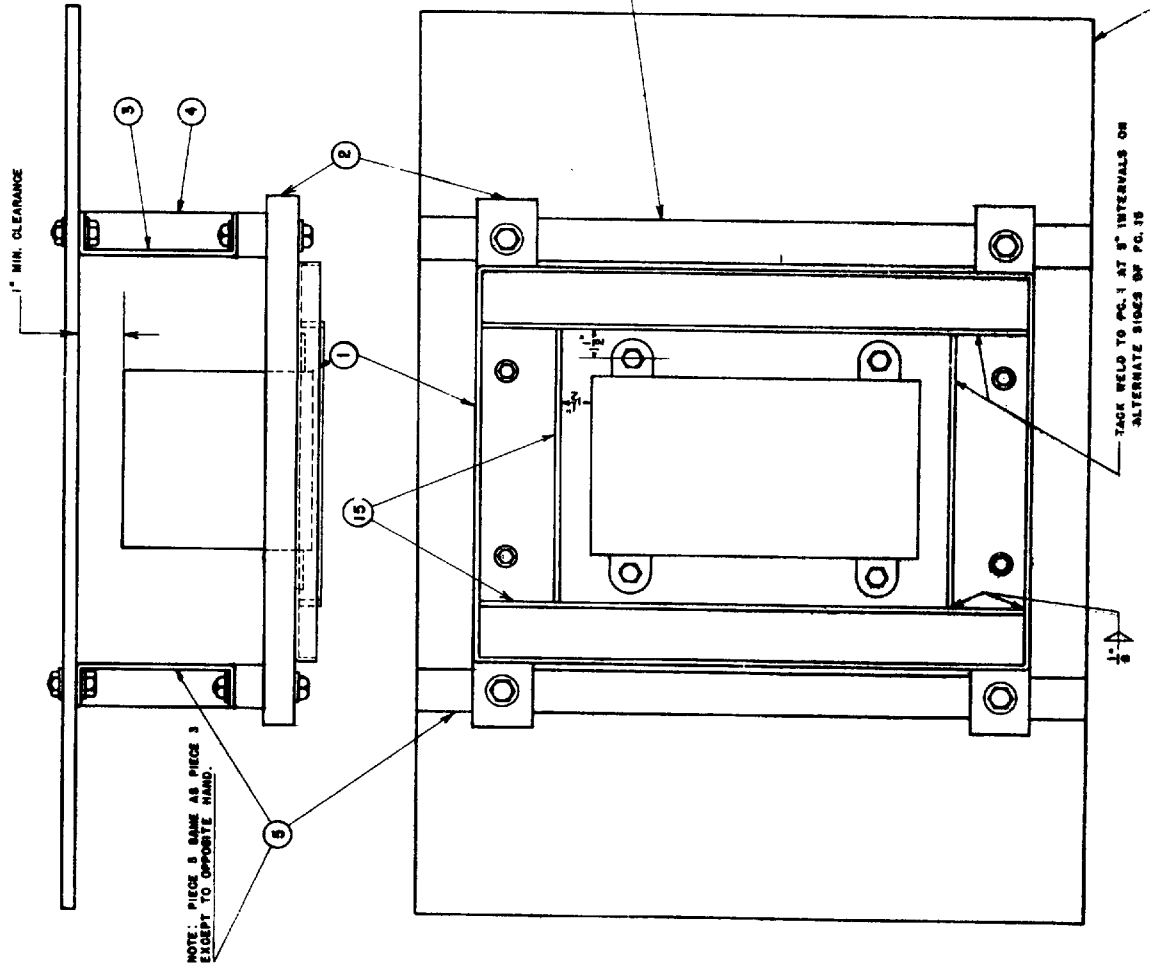
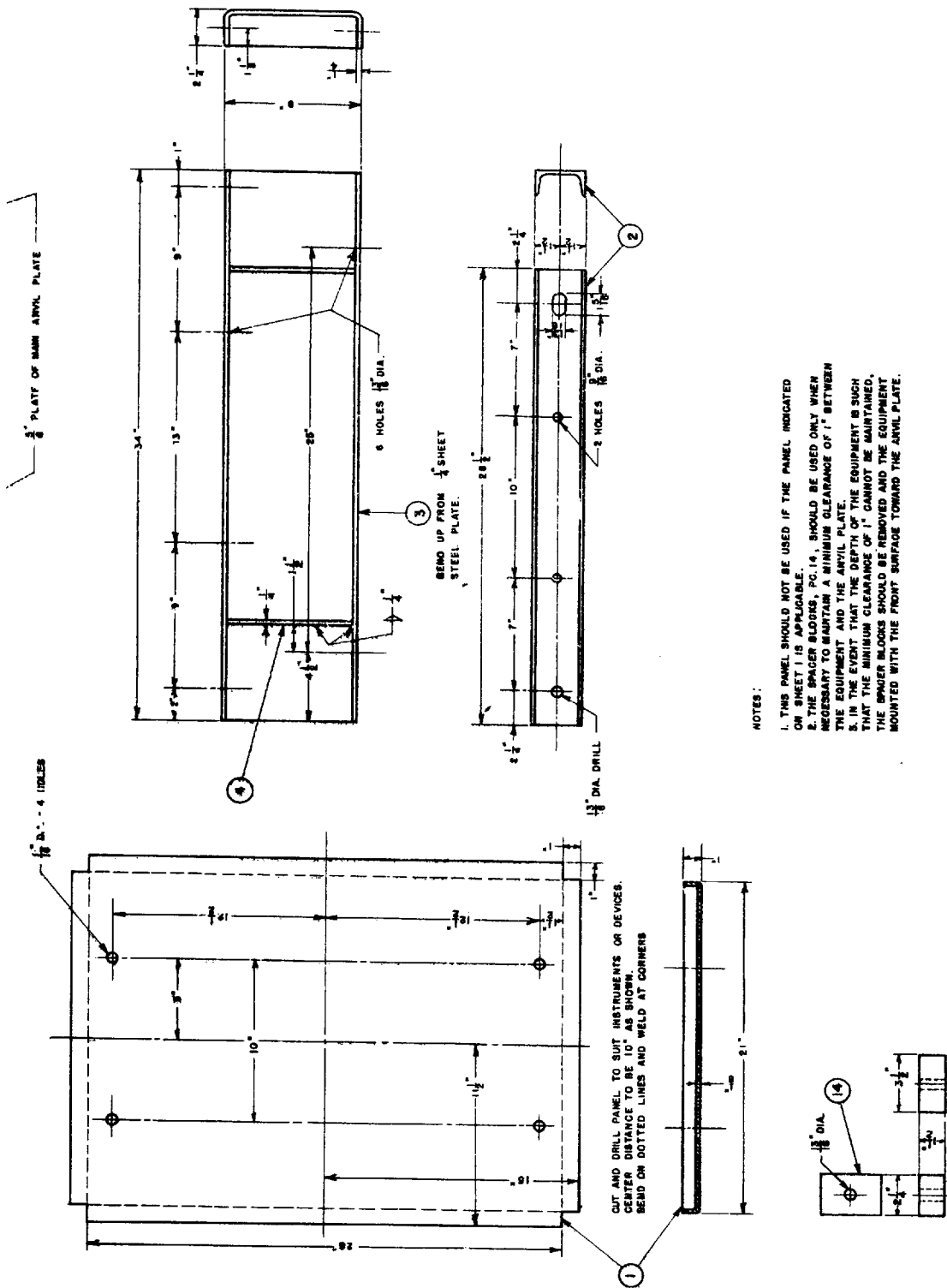


FIGURE 6D.—Standard mounting for electrical indicating switchboard instruments and other panel-mounted equipment: Type "C" test—Light-weight equipment.

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LIST OF MATERIAL				
QUANTITIES ARE FOR ONE MOUNTING				
PIECE NUMBER	NAME OF PIECE	NO. REQD.	MATERIAL	MATERIAL SPECIFICATION
1	PANEL	1	STEEL	
2	STANDARD CHANNEL - 3" X 5.0"	2	STEEL	
3	FABRICATED SPACER	1	STEEL	
4	SPACER STIFFENER	4	STEEL	
5	FABRICATED SPACER	1	STEEL	
6	2-10 X 1/2" LG. HEX. HD. BOLT	8	STEEL	
7	2-10 HEX. HD. NUT	12	STEEL	
8	WASHER - 2" O.D. X 1/4" I.D.	12	STEEL	
9	WASHER - 1 1/2" O.D. X 1/4" I.D.	12	STEEL	
10	2-13 X 1" LG. HEX. HD. BOLT	4	STEEL	
11	2-13 HEX. HD. NUT	4	STEEL	
12	WASHER - 1 1/2" O.D. X 1/4" I.D.	4	STEEL	
13	2-10 X 4" LG. HEX. HD. BOLT	4	STEEL	
14	SPACER	4	STEEL	
15	1" X 1" STRAP	4	STEEL	
16	BLOCK - 2 1/2" X 1 1/2" X 1 1/2"	4	STEEL	





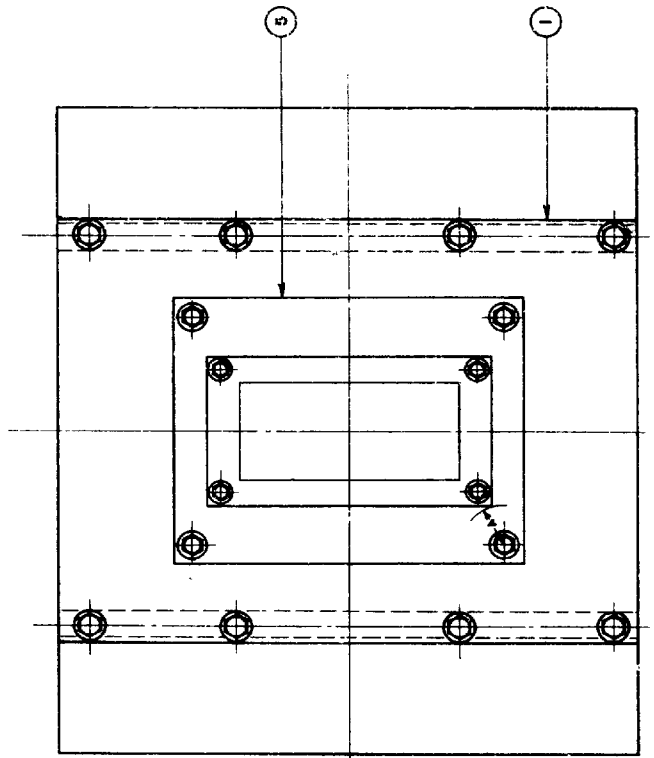
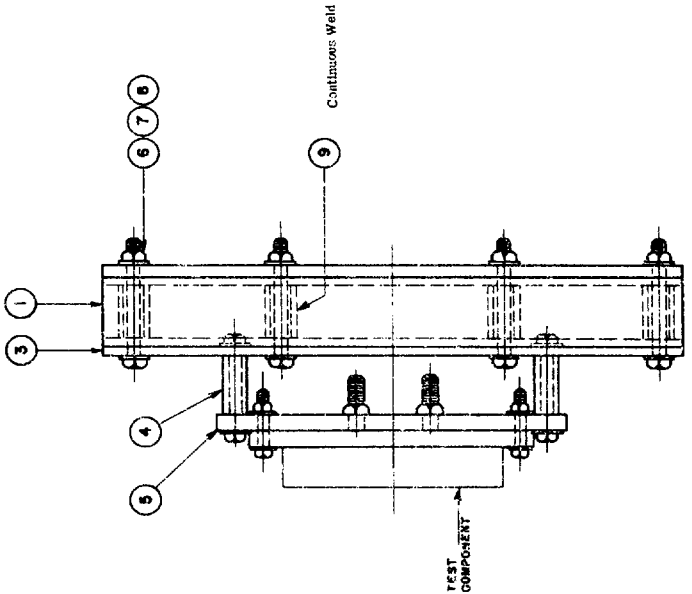
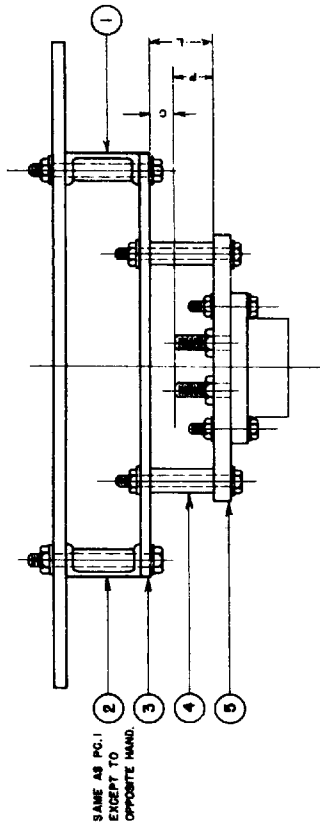
SHEET NO. 2

FIGURE 6D.—Standard mounting for electrical indicating switchboard instruments and other panel-mounted equipment; Type "C" test—Light-weight equipment.

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LIST OF MATERIAL					
QUANTITIES ARE FOR: ONE MOUNTING					
PIECE NUMBER	NAME OF PIECE	NO. REQ'D	MATERIAL	MATERIAL SPECIFICATION	FINISH
1	CAR BUILDING CHANNEL - 4" X 13.8	1	STEEL		
2	CAR BUILDING CHANNEL - 6" X 13.8	1	STEEL		
3	1" X 27" X 3/4" AUXILIARY PLATE	1	STEEL		
4	SPACER (SEE TABLE 1)	-	STEEL		
5	PLASTIC MOUNTING PANEL (NOTE: TYPE 2)	-	TYPE F8 LAMINATED (HEAT TREATED)	MIL-P-15711	
6	1/2" X 7" LG. HEX. HD. BOLT	8			
7	3/16" HEX. HD. NUT	8	STEEL		
8	WASHER - 2" O.D. X 1/8" T.H.	16	STEEL		
9	1" STD. PIPE SPACER - 21 1/2" LG.	8	STEEL		

* THE SIZE OF THE AUXILIARY PLATE SHOULD BE INCREASED TO 1/2" X 36" X 34" FOR PANELS NO. 5 AND NO. 6 LISTED IN TABLE 2.



DIMENSION "A", AS MEASURED FROM THE CENTER OF ANY MOUNTING HOLE OF PG. 8 TO THE COMPONENT MOUNTING BASE, SHALL NOT BE LESS THAN $\frac{1}{2}$ ".

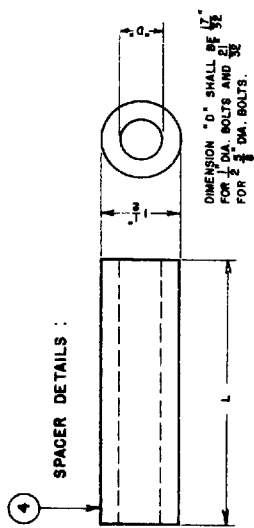
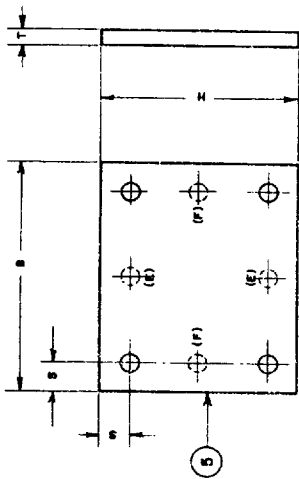


TABLE 1

WHEN P (NOTE ASSEMBLY PLAN VIEW) IS :		L	NOTES :
LESS THAN	GREATER THAN		
$\frac{3}{4}$ "	—	$1\frac{1}{2}$ "	CUT OUT $\frac{1}{8}$ " THICK AUXILIARY MOUNTING PLATE, PG. 5, TO GIVE $\frac{1}{8}$ " CLEARANCE AROUND REAR PROJECTIONS.
$3\frac{1}{4}$ "	$\frac{3}{4}$ "	$P + \frac{3}{4}$ "	
—	$3\frac{1}{4}$ "	4	



HOLES (E) ARE DRILLED EQUIDISTANT FROM CORNER HOLES ON SAME CENTER LINE - PANEL NO. 5 AND 6 ONLY. HOLES (F) ARE DRILLED EQUIDISTANT FROM CORNER HOLES ON SAME CENTER LINE - PANEL NO. 4 AND 6 ONLY.

TABLE 2

PANEL NO.	B	H	T	S	NO. AND SIZE OF BOLTS	DIA. BOLT HOLES
1	9"	12"	$\frac{3}{4}$ "	1"	4 - $\frac{1}{2}$ " x 13	$\frac{9}{16}$ "
2	12"	16"	1"	1"	4 - $\frac{1}{2}$ " x 13	$\frac{9}{16}$ "
3	16"	20"	1"	1"	4 - $\frac{1}{2}$ " x 13	$\frac{9}{16}$ "
4	20"	24"	1"	1"	6 - $\frac{1}{2}$ " x 13	$\frac{9}{16}$ "
5	32"	34"	1"	$1\frac{1}{2}$ "	6 - $\frac{5}{8}$ " x 11	$\frac{11}{16}$ "
6	36"	34"	1"	$1\frac{1}{2}$ "	6 - $\frac{5}{8}$ " x 11	$\frac{11}{16}$ "

SELECTION OF PANEL SIZE : THE PANEL EMPLOYED SHALL BE THE SMALLEST SIZE SHOWN IN THE ABOVE TABLE THAT WILL RESULT IN A CLEARANCE, "A" (NOTE ASSEMBLY FRONT ELEVATION VIEW) OF AT LEAST $\frac{1}{2}$ ".

NOTES:
1. THE MANUFACTURER IS TO PROVIDE THE APPROPRIATE PLASTIC MOUNTING BASE IN PANEL SIZE AND TYPE TO BE USED IN THE LABORATORY FOR TEST.

FIGURE 6E.—Standard mounting for electrical controller components (contactors, relays, resistors, etc.): Type "C" test—Light-weight equipment.

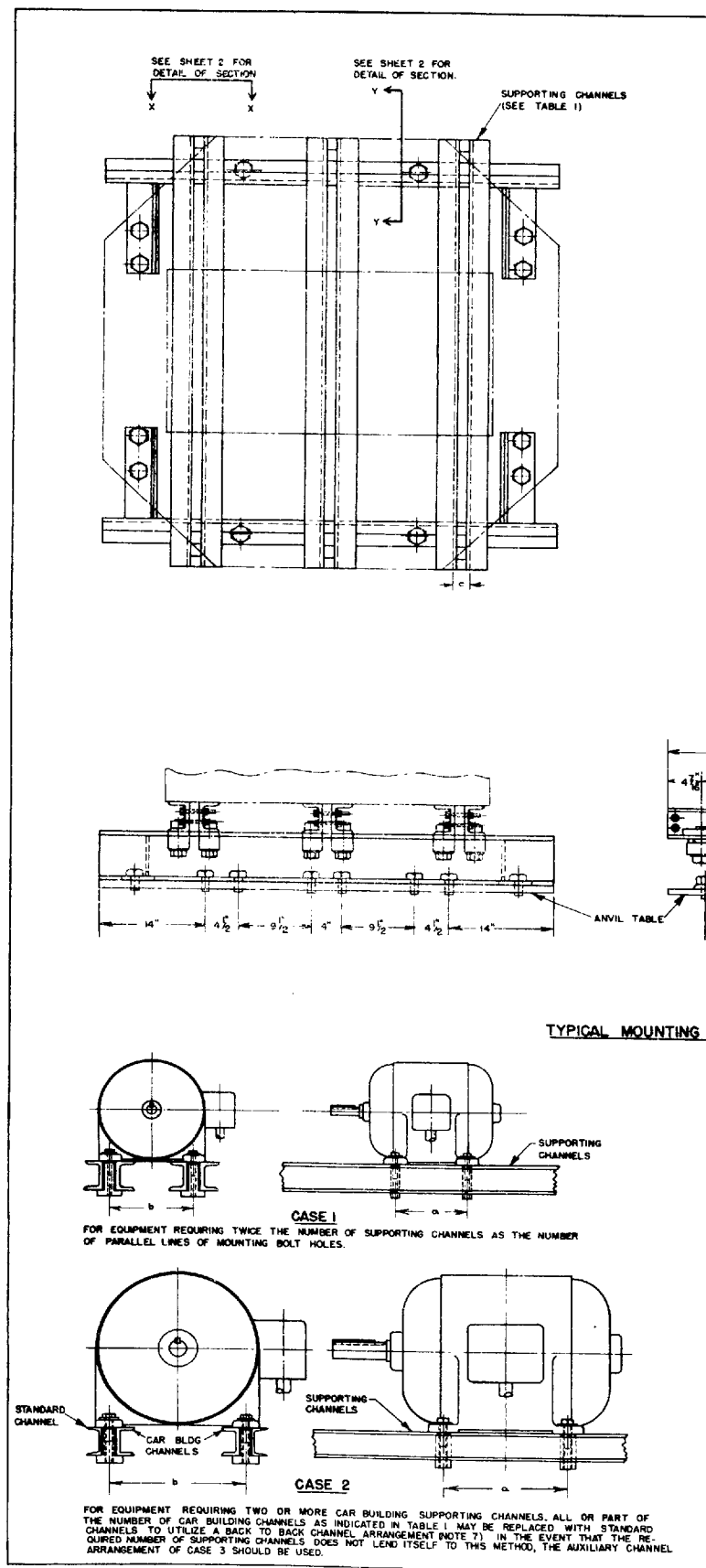
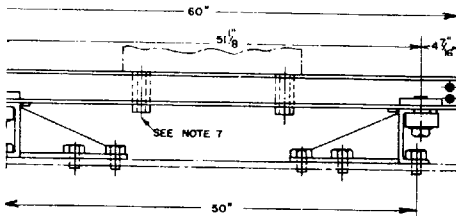


FIGURE 7A.—Standard
22

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NOTES

1. DIMENSIONS "a" and "b" ARE THE EXTREME BOLT HOLE CENTER DISTANCES OF THE EQUIPMENT WITH "b" ALWAYS EQUAL TO, OR GREATER THAN "a".
2. SELECT THE APPROPRIATE NUMBER OF SUPPORTING CHANNELS ACCORDING TO THE WEIGHT AND DIMENSION "a" OF THE EQUIPMENT. SEE TABLE 1.
3. FOR WEIGHT OR DIMENSION "a" NOT LISTED IN TABLE 1, USE THE NEXT HIGHER WEIGHT VALUE AND THE SMALLER DIMENSION "a" WHEN SELECTING THE SUPPORTING CHANNELS.
4. FOR CASES 3 OR 4, THE WEIGHT OF THE AUXILIARY CHANNELS OR PLATES SHOULD BE INCLUDED IN THE EQUIPMENT WEIGHT WHEN SELECTING THE SUPPORTING CHANNELS FROM TABLE 1.
5. TWO STANDARD 4" X 7.25" CHANNELS HAVE A COMBINED STRENGTH EQUIVALENT TO A SINGLE 4" X 13.8" CAR BUILDING CHANNEL AND MAY BE USED IN PLACE OF, OR IN CONJUNCTION WITH, THE CAR BUILDING CHANNELS.
6. WHEN USING STANDARD OR CAR BUILDING CHANNELS BACK TO BACK, THE ENDS OF THE CHANNELS SHOULD BE CLAMPED WITH THE SPACER, PC-9, AND BOLTS SHOWN ON SHEET 2.
7. HOLES SHOULD NOT BE DRILLED THROUGH THE FLANGES OF THE SUPPORTING CHANNELS FOR THE PURPOSE OF BOLTING EQUIPMENT. EQUIPMENT SHOULD BE BOLTED TO THE SUPPORTING CHANNELS BY MEANS OF THE "T" CLAMP SHOWN ON SHEET 2.
8. THE SPACING OF THE SUPPORTING CHANNELS ON THE SHIPBUILDING CHANNELS SHOULD BE GOVERNED, WHEN PRACTICABLE, BY THE POSITION OF THE CENTER OF GRAVITY TO OBTAIN UNIFORM DISTRIBUTION OF LOAD.
9. IF THE EQUIPMENT MOUNTING FEET ARE NOT SUBSTANTIALLY WIDER THAN THE DIMENSION "a", A STEEL PAD SHOULD BE USED BETWEEN THE FEET AND SUPPORTING CHANNELS AT EACH MOUNTING BOLT AND CLAMP.



ARRANGEMENTS

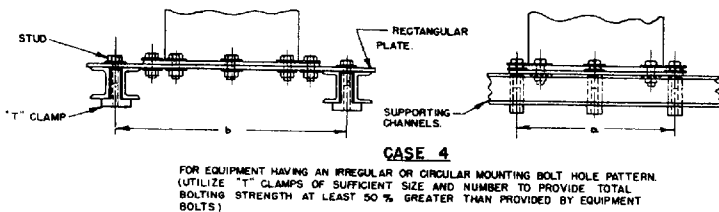
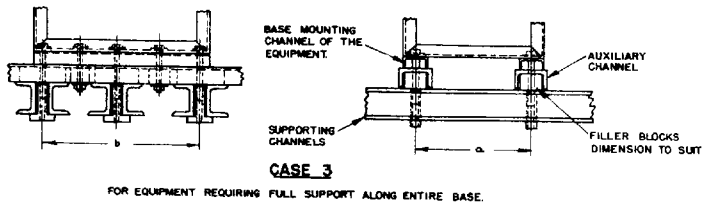


TABLE 1

TABULATION SHOWING THE NUMBER OF SUPPORTING 4" CAR BUILDING CHANNELS REQUIRED FOR A GIVEN EQUIPMENT WEIGHT AND SIZE

WEIGHT OF EQUIPMENT (SEE NOTE 4) LBS.	CENTER DISTANCE BETWEEN BOLT HOLES -																DIMENSION "a" - IN.							
	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44						
500	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
600	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
700	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2						
800	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2						
900	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2						
1000	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2						
1100	4	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2						
1200	4	4	4	4	3	3	3	3	2	2	2	2	2	2	2	2	2	2						
1300	5	5	4	4	4	4	3	3	3	2	2	2	2	2	2	2	2	2						
1400	5	5	5	4	4	4	4	3	3	3	2	2	2	2	2	2	2	2						
1500	5	5	5	5	4	4	4	3	3	3	3	2	2	2	2	2	2	2						
1600	6	5	5	5	5	4	4	4	4	3	3	3	2	2	2	2	2	2						
1700	6	6	6	5	5	4	4	4	4	3	3	3	3	2	2	2	2	2						
1800	6	6	6	6	5	5	4	4	4	3	3	3	3	3	2	2	2	2						
1900	7	6	6	6	5	5	4	4	4	3	3	3	3	3	3	2	2	2						
2000	7	7	6	6	6	5	5	4	4	4	3	3	3	3	3	3	2	2						
2100	7	7	7	6	6	6	5	5	4	4	4	3	3	3	3	3	3	2						
2200	8	7	7	7	6	6	6	5	5	4	4	3	3	3	3	3	3	2						
2300	8	8	7	7	7	6	6	5	5	4	4	3	3	3	3	3	3	2						
2400	8	8	8	7	7	6	6	5	5	4	4	3	3	3	3	3	3	2						
2500		8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	4	3						
2600			8	8	7	7	7	6	6	5	5	4	4	4	4	4	4	3						
2700				8	8	7	7	6	6	5	5	4	4	4	4	4	4	3						
2800					8	8	7	7	6	6	5	5	4	4	4	4	4	3						
2900						8	8	7	7	6	5	5	4	4	4	4	4	3						
3000							8	8	7	7	6	5	5	4	4	4	4	3						
3100								8	8	7	7	6	5	5	4	4	4	3						
3200									8	8	7	7	6	5	5	4	4	3						
3300										8	8	7	7	6	5	5	5	4						
3400											8	8	7	7	6	5	5	4						
3500												8	8	7	7	6	5	4						
3600													8	8	7	7	6	5						
3700														8	8	7	7	6						
3800															9	8	7	7						
3900																9	8	7						
4000																	9	8						
4100																		9						
4200																								
4300																								
4400																								
4500																								

SHEET 1

mounting platform for testing equipment on medium-weight shock-testing machine.

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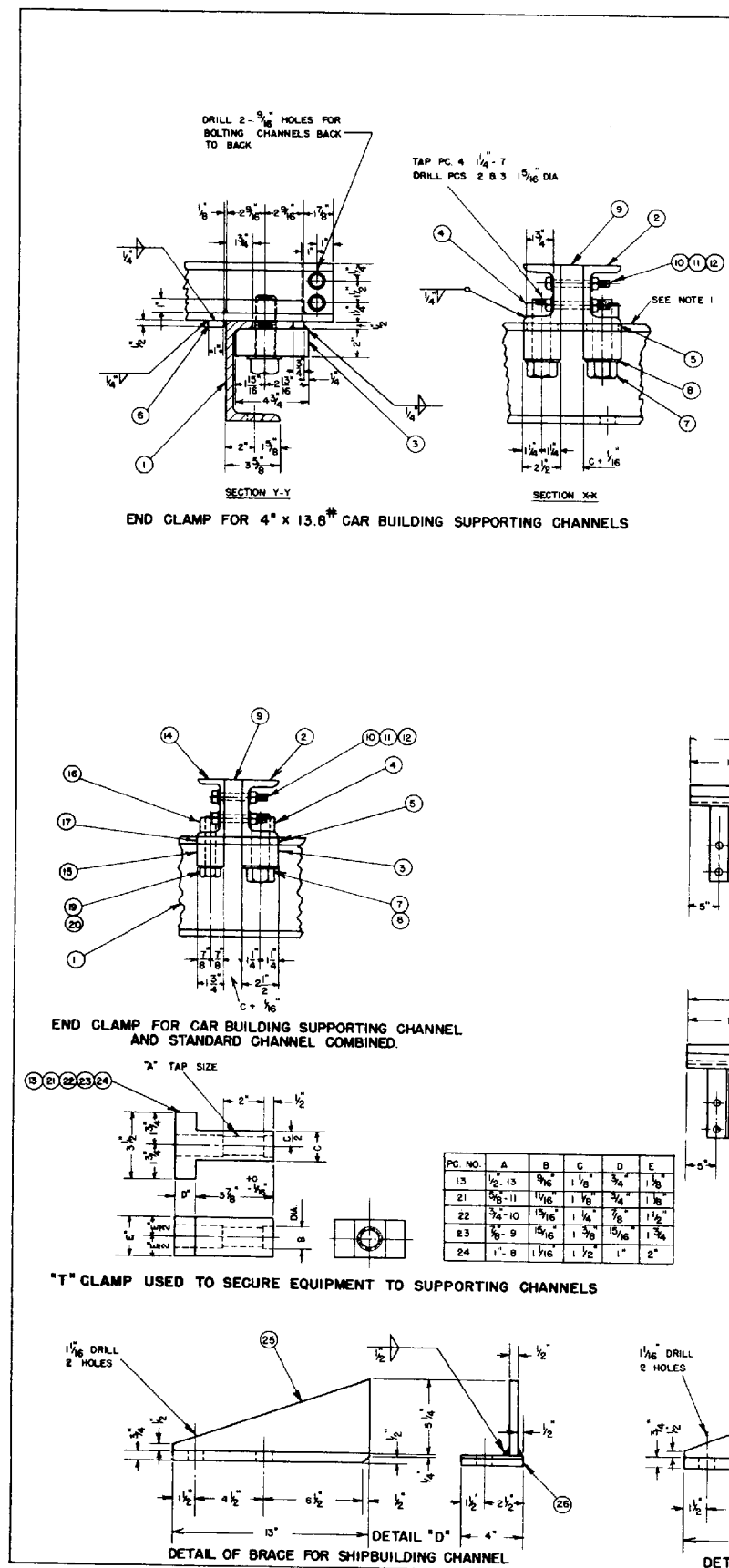
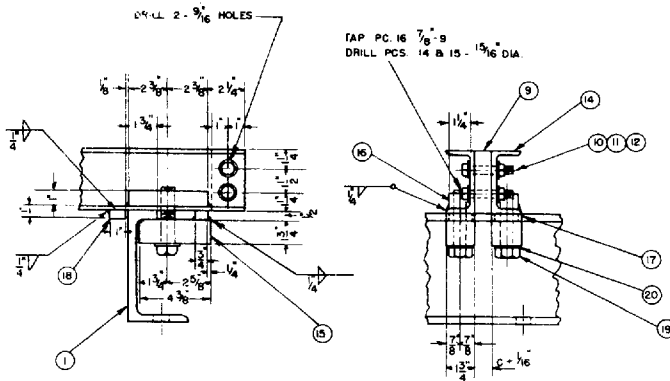


FIGURE 7A. -Standard mou.

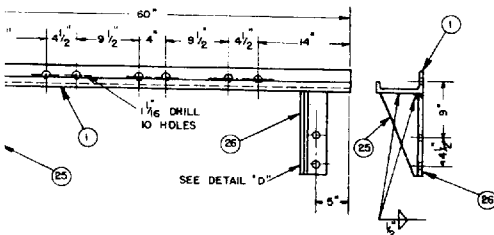


END CLAMP FOR 4" x 7.25" STANDARD CHANNELS

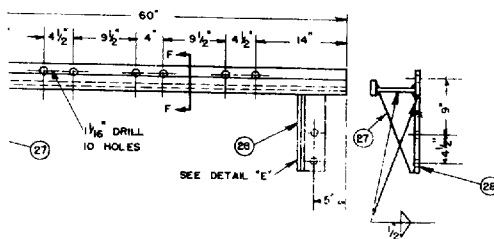
LIST OF MATERIAL					
PIECE NUMBER	NAME OF PIECE	NO REQ'D	MATERIAL	MATERIAL SPECIFICATION	FINISH
1	SHIPBUILDING CHANNEL 1" X 227"	2	STEEL		
2	CARBUILDING CHANNEL 4" X 13.6"		STEEL		
3	CLAMP 2" X 2 1/2" X 4 3/4"		STEEL		
4	BLOCK 1" X 1 3/8" X 5 1/8"		STEEL		
5	PAD 1/2" X 3/4" X 2 1/2"		STEEL		
6	PAD 1/2" X 1" X 2"		STEEL		
7	HEX HD. BOLT 1 1/4" - 7 X 4 1/4" LG.		STEEL		
8	WASHER 1 1/8" I.D. X 2 1/8" O.D.		STEEL		
9	SPACER 2" X 4" X AS REQUIRED		STEEL		
10	HEX. HD. BOLT 1/2" - 13 X AS REQ'D		STEEL		
11	WASHER 3/8" I.D. X 1" O.D.		STEEL		
12	HEX HD. NUT 1/2" - 13		STEEL		
13	CLAMP - SEE TABLE FOR DIMS.		STEEL		
14	STANDARD CHANNEL 4" X 7.25"		STEEL		
15	CLAMP 1 3/4" X 1 3/4" X 4 3/8"		STEEL		
16	BLOCK 1" X 1 1/4" X 4 3/4"		STEEL		
17	PAD 1/2" X 3/4" X 1 3/4"		STEEL		
18	PAD 1/2" X 1" X 1 1/4"		STEEL		
19	HEX HD. BOLT 1 1/8" - 9 X 3 7/8" LG.		STEEL		
20	WASHER 1 1/8" I.D. X 1 7/8" O.D.		STEEL		
21	CLAMP - SEE TABLE FOR DIMS.		STEEL		
22	CLAMP - SEE TABLE FOR DIMS.		STEEL		
23	CLAMP - SEE TABLE FOR DIMS.		STEEL		
24	CLAMP - SEE TABLE FOR DIMS.		STEEL		
25	GUSSET 1/2" X 5 1/4" X 13"		STEEL		
26	PLATE 3/4" X 4" X 13"		STEEL		
27	GUSSET 1/2" X 5 1/2" X 12 3/4"		STEEL		
28	PLATE 1/8" X 4" X 12 1/4"		STEEL		
29	PLATE 5/8" X 2 1/2" X 60"		STEEL		
30	PLATE 3/4" X 6" X 60"		STEEL		
31	PLATE 1/2" X 4" X 60"		STEEL		

NOTES

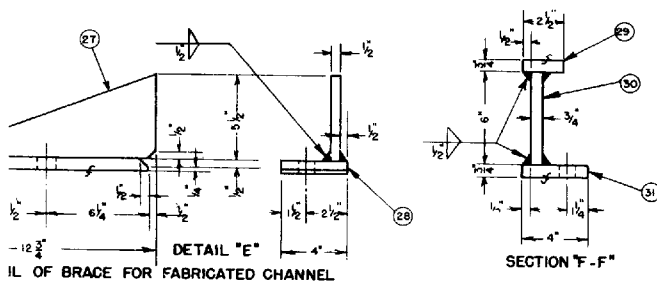
1. BURN OR CUT OFF TOP FLANGE OF ITEM 1 TO INDICATED $1\frac{3}{4}$ WIDTH.
2. SHAPE ITEMS 3 AND 4 TO FIT INNER SURFACES OF ITEMS 1 AND 2 RESPECTIVELY. (SEE NOTE 5)
3. SHAPE ITEMS 15 AND 16 TO FIT INNER SURFACES OF ITEMS 1 AND 14 RESPECTIVELY. (SEE NOTE 5)
4. USE OF EITHER THE STRUCTURAL SHIPBUILDING CHANNEL, ITEM 1, OR THE FABRICATED CHANNEL SHOWN IN SECTION "F-F" IS OPTIONAL DEPENDENT UPON AVAILABILITY OF MATERIAL OR EASE OF FABRICATION.
5. IN THE EVENT THAT THE FABRICATED CHANNEL IS USED, ITEMS 3 AND 15 SHOULD BE SHAPED TO FIT INNER SURFACE OF THE FABRICATED CHANNEL RATHER THAN ITEM 1. THE POSITIONING PADS, ITEMS 6 AND 10, EACH MUST BE SHIFTED $\frac{3}{4}$ " INWARD.
6. USE OF BACK TO BACK SUPPORTING CHANNELS WHICH ARE PERMANENTLY WELDED TOGETHER AT THE ENDS, RATHER THAN BOLTED TOGETHER AS INDICATED IN THESE DETAILS, IS OPTIONAL.



SHIPBUILDING CHANNEL BASE



FABRICATED CHANNEL BASE



SECTION "F-F"

SHEET 2

Testing platform for testing equipment on medium-weight shock-testing machine

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